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Implementation Guideline for Maintenance Line Operations Safety Assessment (M-LOSA) and Ramp LOSA (R-LOSA) Programs

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16. Abstract

This guideline is a general reference guide for preparing for and implementing a Maintenance Line Operations Safety Assessment (M-LOSA) program or Ramp LOSA (R-LOSA) program. The intended target audiences of this guideline are LOSA program managers and members of the implementation team. This implementation guideline outlines and describes 11 major steps in implementing a LOSA program:

1. Obtain senior management's buy-in. If approval is given, then take the following steps:
2. Form an implementation team
3. Market maintenance and/or ramp LOSA programs
4. Integrate with existing safety programs/SMS
5. Develop LOSA infrastructure, including three parallel activities: Adapt/customize LOSA database, Conduct train-the-trainer training, Establish and maintain a virtual LOSA website
6. Adapt/customize and conduct observer training
7. Collect data
8. Validate data
9. Populate and maintain database
10. Analyze data and compile a report
11. Provide feedback to employees

To be effective, a LOSA program needs to address each individual organization's specific needs and complement existing safety programs. However, this guideline emphasizes the following core components to ensure the integrity of any LOSA program:

- Peer-to-peer observations during normal operations,
- Confidential and non-punitive data collection
- Voluntary participation
- Trusted and trained observers
- Joint management/labor sponsorship
- Systematic observation instrument based on Threat and Error Management model
- Secure data collection repository and mining
- Feedback of results to the workforce

Over a course of three years, many companies, organizations, and associated individuals devoted numerous hours planning, designing, building, testing, and refining the many items that constitute the M-LOSA and R-LOSA programs, with the intent of the widest audience use.

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DISCLAIMER

PURPOSE

This guideline is a general reference guide for preparing for and implementing a Maintenance Line Operations Safety Assessment (M-LOSA) program or Ramp LOSA (R-LOSA) program. The intended target audiences of this guideline are LOSA program managers and members of the implementation team. To be effective, a LOSA program needs to address each individual organization's specific needs and complement existing safety programs. However, the following are core components that ensure the integrity of any LOSA program:

- Peer-to-peer observations during normal operations;
- Confidential and non-punitive data collection;
- Voluntary participation;
- Trusted and trained observers;
- Joint management/labor sponsorship;
- Systematic observation instrument based on Threat and Error Management (TEM) model;
- Secure data collection repository and mining;
- Feedback of results to the workforce.

Your organization may want to consider data-sharing with other operators to enhance the power of data-derived knowledge. To maintain consistency and comparability in LOSA observation data and to allow possible industry-wide information sharing in the future, we recommend adopting the data collection forms, training, and databases on www.MRLOSA.com. Over a course of three years, many companies, organizations, and associated individuals devoted numerous hours planning, designing, building, testing, and refining the many items that constitute the M-LOSA and R-LOSA programs, with the intent of the widest audience use. Further, software revision and support will be based on the standardized forms.

Revision Policy

To maintain a high level of accuracy and timeliness of the contents, the guideline should be periodically reviewed, revised, and updated.

Changes to these documents will be noted as follows:

- The index page of this guideline and the header of each page will note the date of revision. For example, following the document title, *(revised MM-DD-YY)* will be added. Only the date of the most recent revision will be noted.
- Within each specific revised section of this guideline, including appendices, all most-recent revisions to the language will be underlined. Underlining will be removed from any revision made prior to the most recent.

Implementation Guideline for Maintenance Line Operations Safety Assessment (M-LOSA) and Ramp LOSA (R-LOSA) Programs

I. Introduction

Background

Managing risks has become increasingly important in modern organizations. The initial identification and interpretation of hazards are some of the most challenging aspects of risk management, since many hazards remain hidden, unnoticed, or misunderstood for long periods of time before an accident. The risks associated with these hazards seem obvious after an accident; however, the early signs pointing to an emerging hazard and its consequent risk are often extremely weak and ambiguous. Three sources of information may be indicative of emerging safety risks: (1) reactive sources highlight issues after an undesired event has taken place; (2) proactive sources look for precursors to undesired events; and (3) predictive sources capture system performance as it happens in real-time, normal operations (Illson, 2006). Line Operations Safety Assessment (LOSA) [1] adopts a proactive and predictive strategy to address aviation safety. As a voluntary safety program, LOSA collects safety data during normal aviation operations. It was originally designed for flight deck operations and has evolved since the mid-nineties. The hazards that threaten the safety of flight deck operations are not unique to that environment. Similar human factors problems are present during maintenance and ramp operations.

Project development background

A Maintenance & Ramp Line Operations Safety Assessment (M-LOSA & R-LOSA) project, sponsored by the Federal Aviation Administration (FAA), was launched in October 2008. The goal was to capitalize on the successes of flight deck LOSA and extend the LOSA methodology to aviation maintenance and ramp operations. Though using a similar methodology employed in flight deck LOSA, the LOSA programs[2] would have to be reshaped to match the requirements of maintenance and ramp environments.

We consulted numerous airline safety representatives who were engaged in current maintenance and ramp LOSA efforts. These personnel brought experience from thousands of LOSA observations from around the world. Review of flight deck LOSA and existing LOSA-themed programs in maintenance and ramp operations informed the design and prototyping of observation data collection instruments and two electronic databases. The development of the maintenance and ramp LOSA procedures and training took an immense amount of effort spanning over three years. After initial development, between September 2009 and November 2010, beta testing allowed input from over 100 maintenance technicians and ramp personnel at five U.S. airports. In April 2011, a maintenance and ramp LOSA trial implementation was conducted, focusing on identifying any weaknesses in the current LOSA programs and gaps to a successful implementation. Refer to www.MRLOSA.com and FAA literature review report (Ma et al., 2011) for more detailed information about the M-LOSA and R-LOSA projects.

Threat and error management

Threat and Error Management (TEM) provides the underlying framework for LOSA data collection, recognizing that threats and errors are likely to occur in normal operations. The TEM model allows LOSA observers to capture the interaction between people and the operational context by recording how frontline employees manage these situations to maintain safety.

There are three basic components in the TEM framework: threats, errors, and undesired operational states (Maurino, 2005). Threats are considered routine events that must be managed to ensure safety. A *threat* is any condition that increases complexity of the operations that demands crew attention and management to maintain safety margins. An *error* is defined as a crew action or inaction that leads to a deviation from organizational intentions or expectations. Errors ultimately reduce the safety margin and increase the probability of adverse operational events on the ground or during flight. Errors normally occur when threats are mismanaged. However, the threat-error linkage is not necessarily straightforward, and it may not always be possible to establish a one-to-one mapping between threats and errors. Errors can be spontaneous without direct linkage to threats (e.g., maintenance technician failing to give a required callout when there is no distraction in the hangar). In the TEM concept, threats and errors must be observable (Maurino, 2005).

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[1] LOSA was originally an acronym for "Line Operations Safety Audit." To better promote voluntary participation and proactive safety culture, several organizations (e.g., International Aviation Transport Association) have redefined LOSA as "Line Operations Safety Assessment."

[2] LOSA program(s) in this guideline refer to M-LOSA and/or R-LOSA programs. Flight deck LOSA is specified as such.

Error outcomes can be of three types. Outcomes of errors can be inconsequential (i.e., no effect on safety), an *undesired operational state* (a risky or unsafe condition for the aircraft, equipment, and/or personnel), or additional error(s) linked together across time. Managing an undesired operational state can be considered the last opportunity to avoid an incident or accident.

Maintenance technicians and ramp employees must adopt countermeasures to keep threats, errors, and undesired operational states from affecting safety (Figure 1). Threats are managed by applying various strategies and tactics. Errors are resolved with a two-layered approach consisting of resist and resolve. *Resist* refers to the variety of safety interventions and work procedures already in place that form defenses in the system such as Standard Operating Procedures (SOPs), checklists, Quality Control (QC) inspections, and automation. *Resolve* refers to the maintenance technician or ramp staff realizing that they had made an error and then correcting it.

Figure 1. Threat and Error Management Model

(Continental Airlines, 2008. Reprinted with permission.)

The TEM model is aimed at understanding error management (i.e., detection and response) rather than solely focusing on error causality (i.e., causation and commission). Regardless of the error type, its effect on safety depends on technicians' and ramp employees' detection and response to avoid an undesired operational state and prevent a potentially unsafe outcome. Using the powerful yet intuitive TEM framework, LOSA allows safety observers to detect threats and errors that technicians and ramp employees themselves might not detect.

Important position of LOSA in SMS

Safety Management System (SMS) is becoming a worldwide standard throughout the aviation industry. The essential idea of any SMS — be it a product/service provider's SMS or the SMS of the regulator responsible for safety oversight — is to provide a systematic approach to achieving acceptable levels of safety risk. Serving as the core of a company's varied safety efforts, SMS provides an organizational framework to support a sound safety culture.

SMS is comprised of four functional components, which, if implemented properly, can lead to a safety culture within the organization.

- Safety Policy — Establishes senior management's commitment to continually improve safety; defines the methods, processes, and organizational structure needed to meet safety goals.
- Safety Risk Management (SRM) — Involves the identification of hazards, assessment of the hazards for risk, and management of the unacceptable risks.
- Safety Assurance (SA) — Evaluates the effectiveness of the SMS.

- Safety Promotion — Includes training, communication, and other actions to train all levels of the workforce on their role in the SMS and to motivate them to willingly carry out this role.

Popular aviation safety programs often focus on the "safety risk management" aspect of SMS (see Figure 2) and can include reactive, proactive, or predictive hazard identification programs. Some examples include (1) voluntary employee reporting programs such as the Aviation Safety Action Program (ASAP) and the Aviation Safety Reporting System (ASRS), which are proactive programs, (2) data analysis programs such as Flight Operations Quality Assurance (FOQA), which is a predictive program, (3) error investigation tools such as the Maintenance Error Decision Aid/Ramp Error Decision Aid (MEDA/REDA), which are reactive programs, and (4) system assessment programs such as Continuing Analysis and Surveillance System (CASS), which is a proactive program. LOSA, a predictive hazard identification program, complements other safety programs by focusing on "safety risk management" by observing the system during normal operations. M-LOSA and R-LOSA are now available to organizations as predictive hazard identification systems for maintenance and ramp, respectively. LOSA processes are critical to the implementation of a functional SMS. SMS also provides significant business benefits such as better operational process management and, consequently, financial benefits.

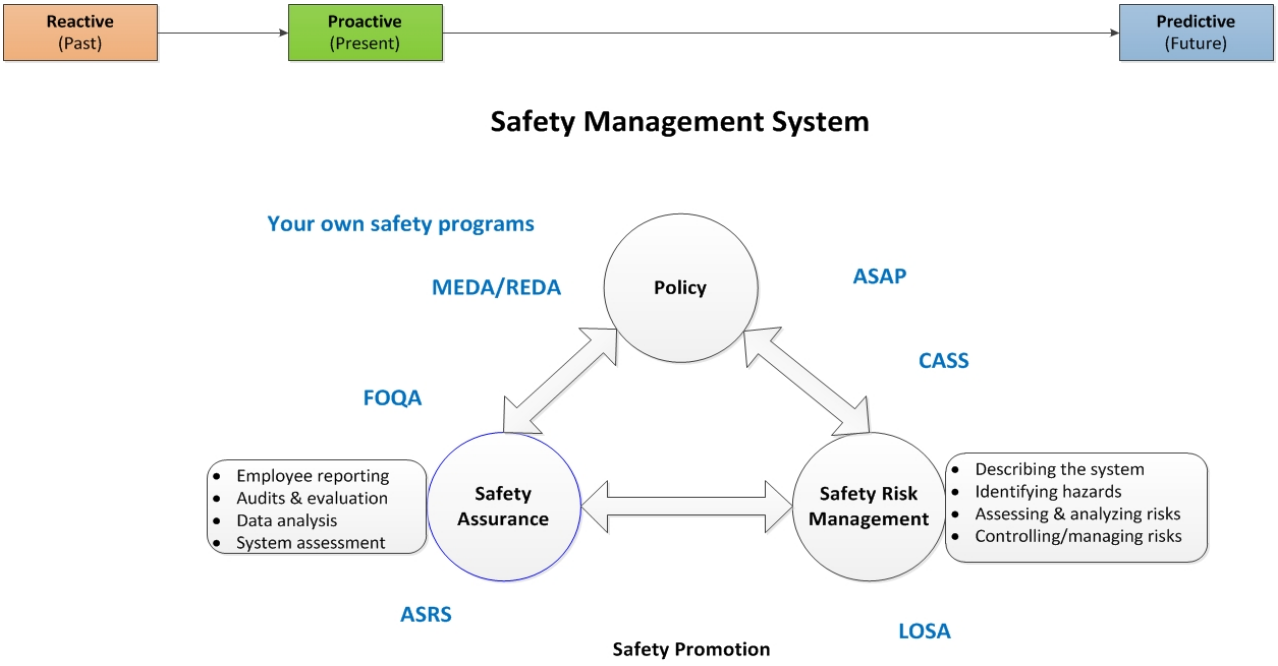

Figure 2. Shift of Safety Culture in Aviation and Various Safety Programs in SMS

The goal of SMS is to (1) encourage the accountable manager of an airline to take responsibility for safety; and (2) understand the existing hazards and maintain the risks from those hazards at an acceptable level. LOSA helps determine whether best practices are being followed and, therefore, supports the continuous improvement philosophy behind SMS.

Purpose of LOSA

LOSA observers are subject matter experts with extensive training in conducting LOSA observations. They record data during a specific observation period. LOSA is not an "audit" program. In fact, it should not be represented or used as an audit program. It focuses on observing normal operations by peers in a non-punitive environment to identify "at-risk" behaviors to implement changes to get employees to work more safely, as well as capture information on effective countermeasures currently in place. LOSA samples activities in normal operations – the vast majority of these are well-managed and successful operations. Confidential data collection and non-jeopardy assurance for frontline employees are fundamental to the process.

Designed to be a project-based safety tool, LOSA brings in safety information derived from data. LOSA contributes to continuous quality improvement over time. As a behavior-based safety program, LOSA observes human behaviors (performing specific tasks). There is no intention to judge whether human performance is good or bad, efficient or not.

Using a medical metaphor, a LOSA is a patient's annual physical examination. People have comprehensive checkups in the hope of detecting serious health issues before they become consequential. A set of diagnostic measures, such as blood pressure, cholesterol, and liver function, can flag potential health concerns. In turn the physical exam could suggest needed changes to the patient's current lifestyle. LOSA is built upon the same proactive and predictive notion. It provides a diagnostic snapshot of strengths and weaknesses that an aviation organization can use to bolster the "health" of its safety margins and prevent degradation.

The development and success of LOSA is based on 10 essential characteristics:

1. Peer-to-peer observations during normal operations,
2. Confidential and non-punitive data collection,
3. Voluntary participation,
4. Trusted and trained observers,
5. Joint management/labor sponsorship,
6. Systematic observation instrument based on TEM model,
7. Secure data collection repository,
8. Data verification roundtables,
9. Data-derived targets for enhancement, and
10. Feedback of results to the workforce.

A LOSA program offers many benefits. To highlight a few:

- Provides field data to support and improve the SMS,
- Identifies strengths and weaknesses of normal operations,
- Reduces undesirable events and operating costs,
- Improves efficiency,
- Improves risk management practices by uncovering at-risk behaviors (hazards), and
- Sensitizes LOSA observers and workers being observed to constant safe work practices.

Overview of This Guideline

Including the introduction, this implementation guideline consists of 11 sections to guide the LOSA implementation process. Each section covers an important implementation step and provides guidelines, tips, key reminders, and additional reading for that particular implementation step.

Practical Implementation Flow Chart

There are 11 major steps in implementing a LOSA program (see Figure 3):

1. Obtain senior management's buy-in. *If go-ahead is given, then take the following steps:*
2. Form an implementation team;
3. Market maintenance and/or ramp LOSA programs;
4. Integrate with existing safety programs/SMS;
5. Develop LOSA infrastructure, including three parallel activities:
   - 5.1 Adapt/customize LOSA database,
   - 5.2 Conduct train-the-trainer training,
   - 5.3 Establish and maintain a virtual LOSA website;
6. Adapt/customize and conduct observer training;
7. Collect data;
8. Validate data;
9. Populate and maintain database;
10. Analyze data and compile a report;
11. Provide feedback to employees.

If considering further LOSA effort beyond an implementation, there are more steps and activities:

12a. Integrate LOSA data and data from other safety programs
12b. Analyze Return on Investment (ROI)
12c. Compile success stories and lessons learned and add them to the training program
13. Participate in industry information sharing meeting

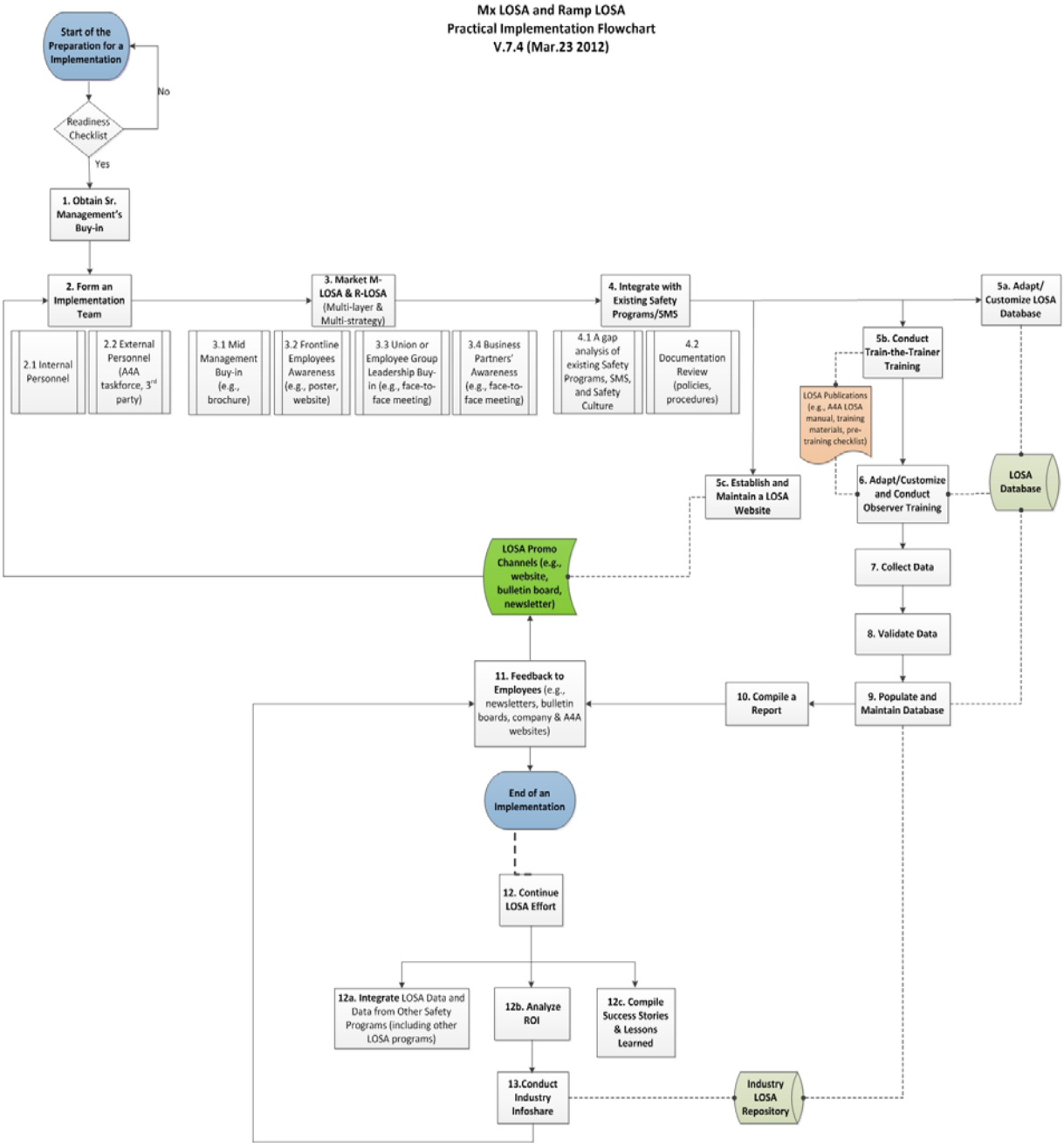

Figure 3. A Practical Implementation Flow Chart for Maintenance and Ramp LOSA

Note: A4A – Airlines for America (formerly known as Air Transport Association of America) To support optimal view, in each section that describes an implementation step, a corresponding segment of the implementation flow chart will be called out.

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FOR ADDITIONAL READING:

- FAA. (2006). Advisory Circular: Line Operations Safety Audits (AC 120-90): Federal Aviation Administration.
- FAA. (2010). FAA Website for Safety Management System: www.faa.gov/about/initiatives/sms
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- ICAO. (2002). Doc 9803 AN/761: Line Operations Safety Audit: International Civil Aviation Organization (ICAO).
- ICAO Website for Integrated Safety Management Section: www2.icao.int/en/ism/default.aspx
- Illson, J. (2006, November). *Integrated Threat Analysis*. Paper presented at the 4th ICAO-IATA LOSA & TEM Conference, Toulouse, France.
- Ma, J., Pedigo, M., Blackwell, L., Hackworth, C., Holcomb, K., & Gildea, K. (2011). 20 Years of the Line Operations Safety Audit (LOSA) Program: From Flight Operations to Maintenance and Ramp Operations. (DOT/FAA/AM-11/15) Washington, DC: Federal Aviation Administration, Office of Aerospace Medicine.
- Maurino, D. E. (2005, April). *Threat and Error Management* (TEM). Paper presented at the Canadian Aviation Safety Seminar (CASS), Vancouver, BC, Canada.
- See "Publications" section on www.MRLOSA.com

II. Preparation Phase

The preparation phase consists of five steps: Assessing Readiness, Obtaining Senior Management's Buy-in, Forming a LOSA Implementation Team, Marketing, and Integrating With Existing Safety Programs/SMS.

Assess Readiness

Before implementing a LOSA program, an organization should first assess its own readiness for LOSA by using the following two checklists.

Must-have checklist:

- ☐ Senior management's committed support for the LOSA effort (including financial commitment).
- ☐ Labor union and/or employee groups' acceptance and participation for the LOSA effort.
- ☐ Labor force's acceptance and participation for the LOSA effort.

Nice-to-have checklist:

- ☐ Safety personnel are familiar with the LOSA concept.
    a. There is a flight or other LOSA program in place.
    b. There is a risk management program or system in place.
- ☐ Non-punitive safety programs such as ASAP, ASRS in place.
- ☐ At least one formal safety data collection and trending program in place.
- ☐ A human factors program in place.
- ☐ Organizational support for Just Culture.
- ☐ Familiar with SMS
    a. Has your organization developed a SMS?
    b. How mature is your SMS? (e.g., Maturity Levels 0-4, www.faa.gov/about/initiatives/sms/pilot_projects/afs_process/index.cfm?print=go).

The above checklist items and questions assess the different aspects of an internal safety environment and the likelihood for LOSA programs to grow successfully. If you do not have all three must-have items, your organization is not ready to implement a LOSA program. Even if you have all the must-have items, but none or only one or two of the nice-to-have items, your organization is unlikely to be truly ready for LOSA program to thrive. Address any issues you identify first, and then come back to prepare for a LOSA implementation.

Step 1: Obtain Senior Management Buy-In

For a LOSA program to succeed senior and upper management must be fully sold on the safety and financial benefits of the LOSA programs (see Figure 4). They must consistently offer their committed support. The LOSA marketing presentation for the highest level executives and management explains the background of the LOSA project, various players involved, LOSA products, implementation process, maintenance or ramp human factors at airlines or ground operators worldwide, and so on.

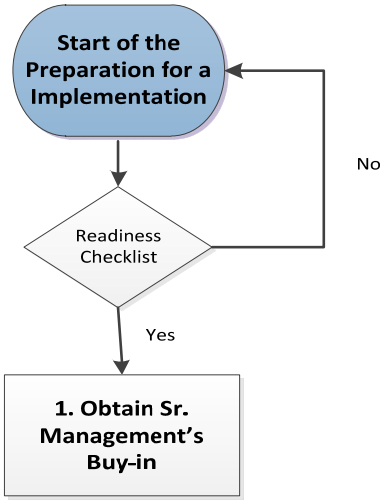

Figure 4. Begin the LOSA Implementation by Obtaining Senior Management's Buy-In

It is critical to obtain senior management's commitment to share fact-based data on LOSA effectiveness with the industry as the LOSA programs grow. Positive outcomes speak for themselves. Fact-based data are powerful at helping move M-LOSA & R-LOSA toward broad implementation and acceptance. Only senior management will have the corporate-wide positive influence regarding sharing de-identified and aggregated fact-based data, on departments such as Legal, Public Relations, and Corporate Communication. Since these departments influence the timely publication of information, it is critical that senior management not let them become a roadblock to success and to safety.

The LOSA marketing presentation or the C-suite and other management takes approximately 45 minutes to deliver, including questions and answers. It is highly recommended to deliver it in a face-to-face format to the level of senior management that has the ability to commit the required resources to implement the program. We have had exceptional success promoting LOSA programs to management teams, often with senior pilot representation, who have had success with LOSA on the flight deck. If your organization has experience with LOSA on the flight deck, then it is important to bring those advocates to the executive meeting.

Step 2: Form an Implementation Team

It is critical to form a LOSA implementation team to develop a plan for the LOSA implementation (see Figure 5). The plan must have specific goals, objectives, scope of the implementation, timeline, and success measures. The implementation team should champion the marketing effort, training, and forming partnerships. It will oversee the implementation process and also monitor and evaluate the team's success toward achieving the plan's goals and objectives.

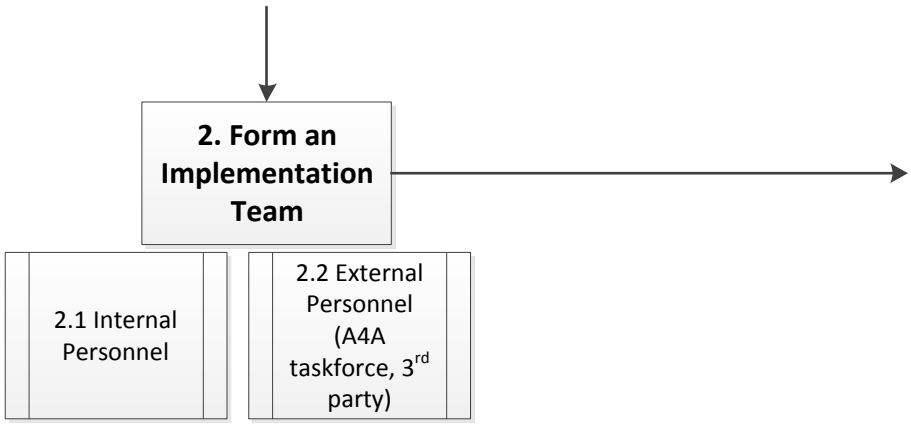

Figure 5. Forming a LOSA Implementation Team

The implementation team must clearly understand the level of commitment that an organization has for LOSA. The team may want to form various working groups as needed. The LOSA implementation team (8-10 key members, depending on the scale of initial implementation) should include both internal and external members:

- Internal members should represent at least the following departments and functions: safety, operations, training, employee representatives, senior management, LOSA program manager, and data analysts.
- All team members should be willing participants and generally support safety and/or continuous improvements. Beware of members who were "volunteered."
- External members: industry representatives.

The LOSA program manager should assume the leadership role for the implementation team. External members on the implementation team support and advise on activities such as use of LOSA observation forms, observer selection and training, and data collection and analysis.

The operations, quality assurance (QA), and training departments typically know first-hand what is and is not working well in their organizations. These departments often have specific areas of concern upon which they would like the LOSA observations to focus. The operating departments need to be included in the implementation process. If these departments do not support LOSA, then there may be resistance to the findings and any subsequent corrective actions.

The importance of having the labor union and/or employee groups involved with and supporting the LOSA cannot be overstated. If the frontline employees are convinced that their union supports LOSA, they will be more willing to accept the presence of observers. Additionally, if the employees believe this process is beneficial to their daily work effort and safety, they will be forthcoming and candid with their views and safety concerns. On the other hand, if the technicians or ramp employees view LOSA as a management tool to "spy on their performance" and they respond with "angel" performance rather than typical performance, then the results will not be fruitful.

Main tasks during the preparation stage

The LOSA implementation team is responsible for all steps outlined in the practical LOSA implementation flow chart (Figure 3). In the preparation stage, the team will engage in the following tasks.

(1) Gather Information and LOSA Resources From Other Organizations and Industry Groups. Before conducting a LOSA for the first time, the implementation team and the program manager should review all materials provided on www.MRLOSA.com. It is helpful to seek out information from other organizations that have already conducted a LOSA. Other airlines and ground operators may be able to share observer selection and training techniques, customized observation forms, scheduling tips, and other logistical aids.

(2) Publicize LOSA Within Your Organization and Send a Letter to the Frontline Employees. A first task is to publicize LOSA via company publications and communication venues to build employee awareness and acceptance. Next, the implementation team should organize and distribute a letter to all technicians or ramp employees explaining the purpose of the LOSA that clearly describes the goals of the process. This letter specifies the purpose of the observations, the fact that all observations are of a non-jeopardy nature, and that all data are de-identified and will be kept strictly anonymous. The letter should be signed by the highest level of management within maintenance or ground operations; with the endorsement of other relevant personnel such as supervisors' and employee groups' representatives. The letter of announcement should precede the observations by at least one month, with a follow-up reminder one week before starting observations. LOSA observers should have copies of the signed letter to show technicians or ramp employees in case questions arise. In addition to the letter, it is important for the implementation team to organize all employees to attend LOSA awareness training, which will be discussed in detail in the "LOSA Infrastructure Development Phase" of this guideline.

(3) Decide on the Focus of the LOSA. The implementation team should develop an implementation strategy. One option is to carry out LOSA observations on a broad sample of the entire operation — this would be an effective strategy for a first LOSA. Alternatively, the LOSA implementation team can focus on specific areas that have been identified by other data sources, such as ASAP. This approach would schedule LOSA observations on particular types of tasks, on particular aircraft types, or in particular locations that have been identified as problematic. The implementation team can also focus a LOSA on a new aircraft type in the fleet or other recent organizational changes. If a phased approach is adopted, such as location by location, the operator should tailor the communication plan accordingly.

(4) Decide on the Size of Implementation. Always start with a trial LOSA implementation, focusing on a particular operation or region, for example, a single station instead of a hub. Depending on the size of the operation and available resources, decide on the number of observations to be completed, shifts of observations, and the number of observers to be trained, etc. Within each location, try to sample as many different technicians or ramp employees as possible to capture a representative sample. As a general guideline for a full LOSA implementation, match the number of observations per

location to the relative number of technicians or ramp employees. For example, 30% of technicians are assigned to Location A, then approximately 30% of the LOSA observations should occur at Location A.

(5) Decide on the Timing of Implementation. The implementation team needs to consider several factors when scheduling a LOSA implementation. Given all the personnel involved, a LOSA should be scheduled to fit with other operational priorities. For example, is there a particular time in the year when more observers will be available? Is there a better time for the scheduling department to roster observers and technicians or ramp employees? Also, is there a particular time that is more interesting from a safety or operational perspective? Examples of interesting times include bad-weather season, peak-traffic season, and after the introduction of an operational change such as new aircraft or a merger.

Please note that a LOSA should not be implemented immediately after a major incident or accident. Your organization will be in a heightened state of awareness at this time, and technicians or ramp employees will be overly sensitive to observation; hence, the chances of getting normal data will be diminished.

Step 3: Market LOSA

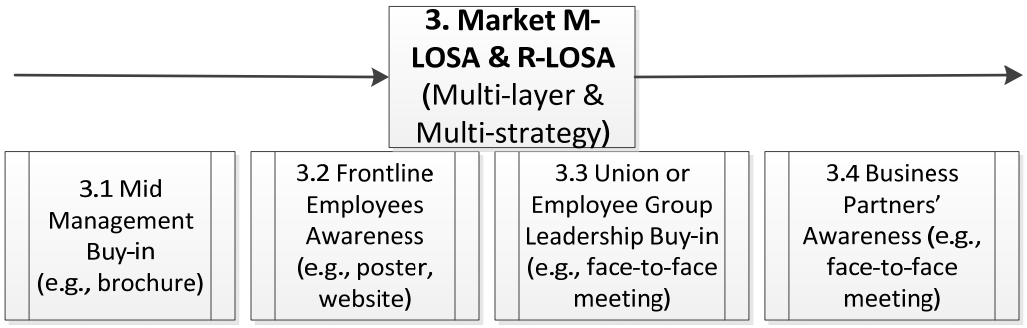

Figure 6. Step 3: Market M-LOSA & R-LOSA

Organizations are naturally resistant to change. Therefore, LOSA will need to be sold through a multi-level and multi-strategy marketing plan. The following marketing strategy and methods are recommended for the various audiences (see Table 1).

Table 1. Multi-Level and Multi-Strategy Marketing Effort for LOSA Programs

Audience	Strategy and Methods
Middle management	Face-to-face meeting, brochure, project website
Labor union and employee group	Face-to-face meeting, project website
Frontline employees	Standardized posters, project website, letter/reminder from the implementation team
Business partners	Face-to-face meeting, project website

A good marketing plan should clearly define the safety value and benefits of a LOSA program. Examples of beneficial outcomes from other M-LOSA and R-LOSA programs are powerful in delivering this message. For upper management, using examples to quantitatively illustrate how the LOSA program can reduce cost. The section "Step 12b: Measure success by calculating Return on Investment (ROI)" provides a system for such calculations.

Second, the marketing plan should clarify how the LOSA program will complement existing safety programs. Frontline employees need to understand how they will fit into the overall picture. LOSA is not an audit process, which many organizations already do. It is important for the LOSA implementation team (especially external members) to understand the current in-house safety programs, including all voluntary non-punitive reporting programs. Then the implementation team will know how to distinguish and contrast LOSA from other existing safety programs when promoting LOSA. Management will be concerned whether LOSA and existing safety programs overlap in function, methods, and outcomes. The marketing plan should explain how duplication will be avoided and the value and impact that the LOSA program will bring to the frontline workforce. Leadership of labor unions and/or employee groups needs to communicate information to the frontline employees and promote buy-in.

Third, the marketing plan should clarify how the LOSA program will fit in the SMS grand scheme. For instance, how data will feed into the overall safety system, how data are going to be integrated, and how results will be presented to employees. Conversations regarding LOSA outcomes should be customized for the different audiences.

Communicate often and broadly during the implementation and align the communication with operational areas. Paying special attention to raising awareness of LOSA and obtaining buy-in at the beginning of a LOSA implementation will assume a positive outcome (see Figure 7). It is important to invite affected business partners in the LOSA initiative from the very beginning. For example, from a carrier's standpoint, there are benefits in having contractors implement their own LOSA process.

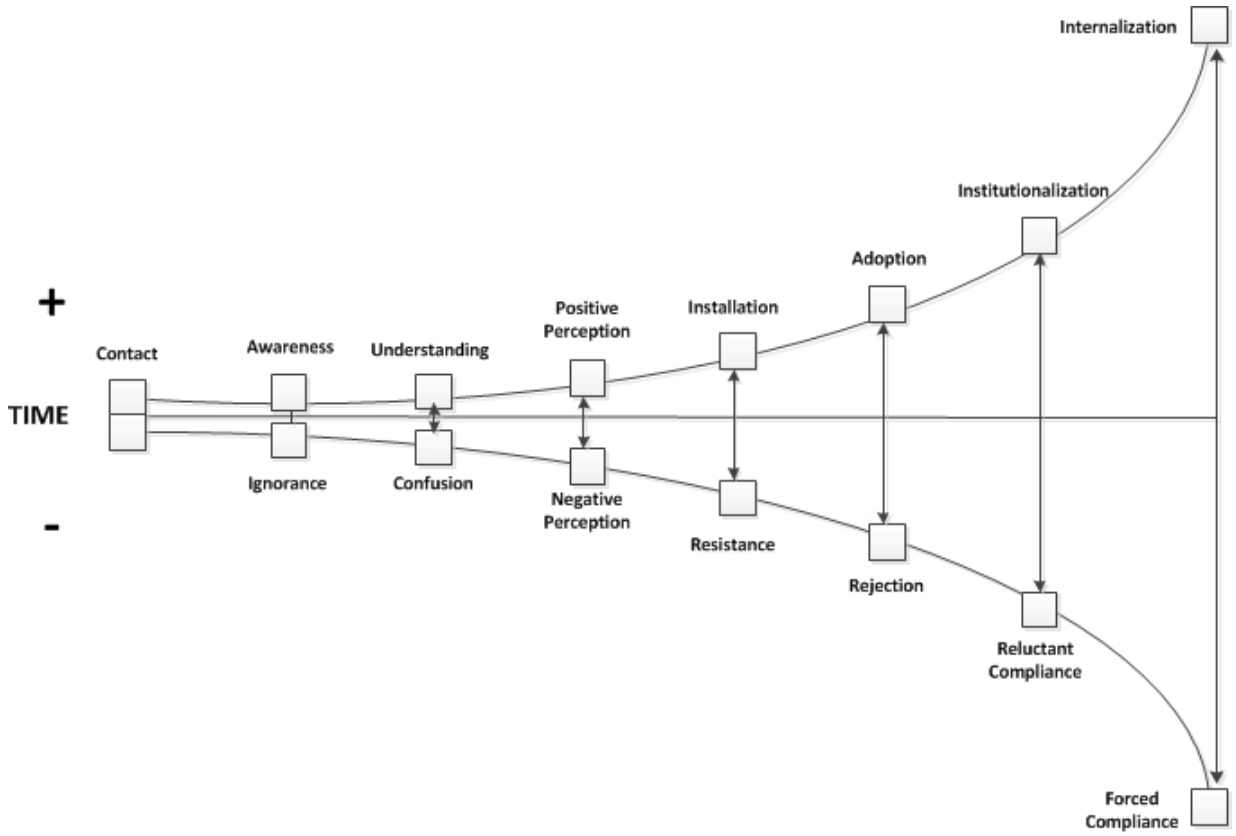

Figure 7. Importance of Raising Awareness and Obtaining Buy-In

Source: *Workshop on Project Management for Supply Chain Managers.* Center for Supply Chain Management Studies. Saint Louis University. August 5 & 12, 2011

Organizational Change Management Form (Appendix A) and Resource Requirements RACI (Responsible/Accountable/Consulted/Informed) Chart (Appendix B) are useful tools for engaging various stakeholders during planning and practicing good project management during an M-LOSA or R-LOSA implementation. The Organizational Change Management Form specifies stakeholders' involvement, their needs and demands for communication and training, and resource allocation. The Resource Requirements RACI Chart defines how implementation team members or function roles share the responsibilities for each deliverable.

Step 4: Integrate With Existing Safety Programs/SMS

The implementation team should conduct a gap analysis to understand the existing safety programs, SMS, and safety culture (see Figure 8).

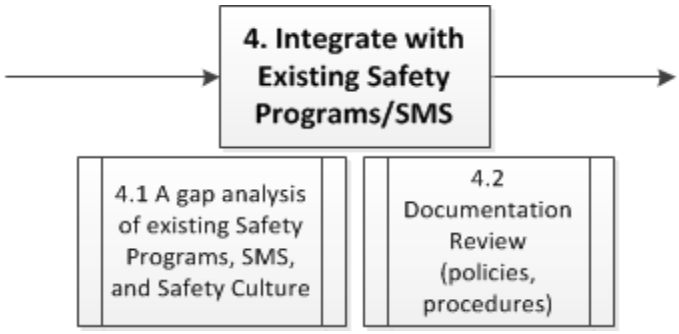

Figure 8. Step 4: Integrate With Existing Safety Program / SMS

This analysis assesses how LOSA would fit into the existing safety programs. It will also help determine the steps to be taken in moving from a current state (i.e., prior-LOSA integration) to a desired future state (i.e., post-LOSA integration). A gap is sometimes spoken of as "the space between where we are and where we want to be." Gap analysis is an essential activity that allows the implementation team to determine, document, and address the variance between LOSA requirements and current safety practices. First, review and describe the existing safety programs by listing each program's attributes, processes, competencies, and performance levels. Second, cross-list factors required to achieve the future objectives (i.e., the 10 essential LOSA characteristics). A comparison of the current elements of the safety system and the new LOSA requirements or objectives will give an idea of whether a gap exists. If there is a gap, there will be discrepancies between what the organization wants and what is already in place. This comparison may take the form of a "Gap - Yes/No" column (see Table 2) to identify where the gaps exist for each element. The last step in the gap analysis is to make recommendations by identifying the items or solutions needed to fill the gap, if a gap exists. The risks and effects of introducing or implementing the item or solution can also be assessed. Gap analyses often results in action plans, which contain task assignments, schedules, resource allocations, and evaluation criteria for each recommendation. These action plans should be used to guide the LOSA implementation.

Here is a list of methods for the implementation team to gather information for the gap analysis:

- Focus group discussion with the safety department (e.g., observation/audit methodologies, data types),
- Review operational policy and procedures, especially disciplinary procedures,
- Assess SMS maturity,
- Survey the safety culture, and
- Develop LOSA characteristic chart.

Table 2 is an example of a template that can be used to conduct a gap analysis.

Table 2. A Sample Gap Analysis Table

Gap Analysis Table			
Currently in place	**New Program Requirements**	**Gap Y/N**	**Items needed**
Process and performance audits by the Safety and QA departments	*Peer-to-peer assessment* through observations of normal operations	Y	• Observation instrument • Database (software) • Observer training
Non-punitive voluntary self-reporting programs, e.g., ASAP	Peer-to-peer assessment of *normal operations* using *systematic observation instrument*	Y	• Observation instrument • Database (software) • Observer training
Etc.			

If you are interested in learning more about gap analysis, please refer to the For Additional Reading section below.

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TIPS:

- Delimit the initial implementation to a small, manageable sector.
- Timeline for the implementation team:
  - 3 months prior to a planned implementation: review readiness checklist
  - 2 months prior: conduct a meeting or a telecon, go through the checklist of to-dos, figure out logistics
  - 1 month prior: conduct in-person meeting
- Promote LOSA at multi-levels of an organization through various strategies and methods.
- Emphasize that LOSA is not for disciplinary purposes and that the observation forms do not include any personal information.
- Be prepared to discuss the financial rewards of a LOSA program, especially when briefing senior management.
- Gap analysis is an essential activity to determine, document, and address the variance between LOSA requirements and current safety practice.

KEY REMINDERS:

- Assess readiness and ensure buy-in.
- Fundamentals are critical.
- Communication to everyone through awareness training or other channels is critical.
- Do not rush a LOSA if your organization is not ready. Allow time for your safety culture to mature if necessary.

FOR ADDITIONAL READING:

- LOSA marketing materials and templates (e.g., awareness posters) are available at the "Marketing Materials" section of the project website: www.MRLOSA.com
- FAA. (2006). Advisory Circular: Line Operations Safety Audits (AC 120-90): Federal Aviation Administration.
- IATA Airport Handling Manual (AHM) - 31st edition www.iata.org/ps/publications/Pages/ahm.aspx (see IATA's AHM 640).
- ISO 9001 (2008) Gap Analysis Tool. www.praxiom.com/iso-gap.htm
- Transport Canada (2010). Gap Analysis Form: www.tc.gc.ca/eng/civilaviation/publications/tp14343-appendixb-610.htm
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III. LOSA Infrastructure Development Phase

Step 5a. Construct LOSA Database

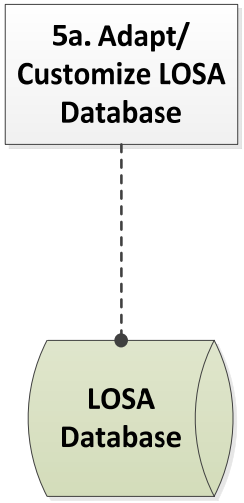

Figure 9. Step 5a: Adapt/Customize LOSA Database

Structured Query Language (SQL), designed for managing data, was used to develop the M-LOSA database and the R-LOSA database. SQL is the most widely used database language and offers the capability to insert, query, update and delete, create database structure, and provide data access control. With modifications, SQL code can be ported between database systems (e.g., Microsoft SQL Server, Oracle, Teradata, MySQL). Each organization should be aware of this when adopting the above LOSA databases, and/or when integrating the LOSA databases with other safety databases inside its organization. The LOSA implementation team should work closely with their database administrators to adapt and deploy the LOSA database.

The LOSA observations can be kept in-house if data management and analysis expertise is available and if data security can be assured. Alternately, the data can be sent to a trusted third party who will assume responsibility for data input, cleaning, and analysis. The decision will depend on an organization's resources.

The LOSA program manager should organize a secure site for the data and oversee the receipt of the observation forms and subsequent data analysis. The program manager should be able to protect the identity of the observed to ensure complete confidentiality and non-jeopardy conditions. Under no circumstances should it be possible to connect individuals with particular observations.

Staffing needs

A database administrator and a data analyst are essential to effectively using the LOSA databases. To adopt the above SQL databases, the administrators need to be proficient with SQL databases. The analysts may also be required to have relevant professional certification. For instance, Microsoft Certified Database Administrator (MCDBA) and Microsoft Certified Systems Engineer (MCSE) certification cover Microsoft SQL Server as one topic area in the certification examinations. The Microsoft Certified Technology Specialist (MCTS) credential enables professionals to target specific technologies, and is generally the first step toward the professional-level certifications. SQL Server Specialization is one of the MCTS specializations. Another key responsibility of the data administrator is to maintain the databases by periodically backing up the SQL Server to minimize data loss in case the data become corrupted. Some third-party tools allow backup and provide additional capabilities.

The data analysts should be familiar with an organization's operations, as well as have data analysis skills. The data analyst and report writer work together to prepare reports of the findings to be presented to management, labor groups, and frontline employees.

An organization might choose a third-party analyst if expertise is not available in-house, or if frontline employees have expressed reservations about the integrity of the LOSA implementation or the objectivity of the final report.

Data standardization

Several supplementary techniques ensure that good, quality standardized data are used in a LOSA program.

(1) Observers are not asked to evaluate performance, but simply to observe it. From a data standpoint, this is the distinction between subjective judgment and objective observation. For example, observers are asked to note threats without any subjective judgment — if there is a thunderstorm, record it; if there is a malfunction or equipment problem, record it. It is the same for errors and undesired operational states. Observers also note the frontline employee's response to threats, errors, and undesired states and the outcome. The observer is not assessing the employee's performance or providing a subjective evaluation. The observer is providing an overview of the situation.

(2) The data verification process involves checking observation forms submitted by observers against the written description and comments. Observers are experts at describing a maintenance or ramp procedure. They are not necessarily expert at assigning codes to the various threats and errors, especially if it is their first time as a LOSA observer. Although training is given on how to code, it is realistic to assume that observers will not necessarily retain this information perfectly. The comments are the "fail-safe" in the system in that they allow the analyst to read the events of the observation and match them to the observer's codes. Because the analyst should be an expert with the codes, he/she can add any codes that were missed and recode anything that might not be correct. Hence, good quality comments are the ultimate key to standardized data. Observers provide comprehensive descriptions and comments, and the analyst ensures consistent and accurate coding.

(3) Standardizing the LOSA data prior to analysis also involves verifying the data with a team of local experts. For example, airline personnel familiar with the maintenance operation: maintenance managers, representatives of the airline's maintenance labor group, or members of the LOSA implementation team. LOSA observers should be included whenever it is possible. The group's task is to review and verify the observations against current manuals, policies, and procedures. For example, an observer might log a procedural error for failure to lock out and tag out, when in fact there is no such written procedure in the maintenance manual. The "error" would then be deleted from the database or marked as an omission from the maintenance manual. The data verification group acts as a check on the threat and error coding, ensuring events are correctly recorded in line with procedures and policies. It also builds ownership in the results and dispels any later criticism that the coding was not accurate.

Your organization may consider data-sharing with other operators to enhance the power of data-derived knowledge. Standardized data are critical for possible industry sharing and comparison using one singe repository over the long run.

Step 5b: Conduct Train-the-Trainer Training

Make sure that staffs accept the LOSA concept before the implementation team comes in to deliver LOSA training.

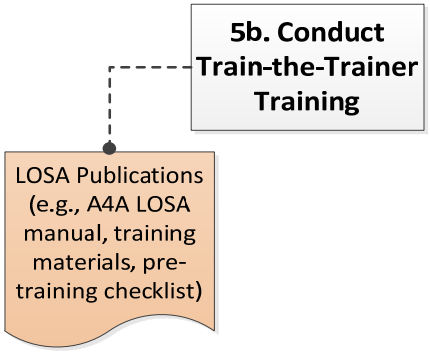

Figure 10. Step 5b: Train-the-Trainer Training

Training preparation and customization

The gap analysis provides implementation team with a good understanding of how LOSA is different from existing safety programs and the contextual information for adopting LOSA training. LOSA training should be customized for different purposes and audiences. In particular, the implementation team should supply examples and cases to best customize and localize the LOSA training. The following set of PowerPoint training (see Table 3) and corresponding quiz

questions are available for download from www.MRLOSA.com. This training is recommended to be adapted to suit your organization's specific needs and safety environment.

Table 3. Recommended LOSA Training Segments

Specific LOSA Training Components	Key Contents	Duration and Format
1. LOSA Awareness Training	• M-LOSA & R-LOSA background • TEM • Brief ROI	Less than 1 hour; in-person or Computer-based Training (CBT)
2. LOSA Train-the-Trainer	• LOSA Awareness training (full) • TEM • LOSA products • Implementation process • Forms/Scenarios (Maintenance LOSA and/or Ramp LOSA) • Database • Reporting	16-18 hours; in person with hands-on observation and database practice and "teach-back" session
3. LOSA Observer Training	• LOSA Awareness training (full) • TEM • LOSA products • Implementation process • Forms/Scenarios (Maintenance and/or Ramp LOSA) • Database • Observation protocol	16 hours; in person with hands-on observation and database practice
4. LOSA Database Training	• Set up LOSA database • Maintain LOSA database • Customization	2 hours; in person with hands-on database practice
5. LOSA Reporting Training	• Reporting	1-2 hours; in person with hands-on database practice

Each training segment is designed for differing audiences. Trainers should carefully consider the needs of each group when selecting and tailoring the training. Certain training segments are suggested for the various audiences (see Table 4).

Table 4. Target Audiences of Various LOSA Training Segments

	Targeted Audience						
Specific LOSA Training	Frontline Employees (non-observers)	LOSA Observers	LOSA Trainers	LOSA Program Managers	LOSA Analysts	Management	Business Partners**
LOSA Awareness Training	×	×	×	×	×	×	×
LOSA for the C-Suite and Management						×	
LOSA Train-the-trainer			×	×			
LOSA Observer Training		×			×		
LOSA Database Training		×*	×	×	×		
LOSA Reporting Training			×	×	×		

*At some organizations, LOSA observers may enter data themselves.

**Depending on how involved the business partners are in the LOSA initiative, they may participate in all or some of the available LOSA training.

LOSA awareness training

LOSA awareness training is to ensure employees know the fundamentals of LOSA, its purpose, and how it is different from other safety programs, especially other voluntary, non-punitive reporting programs. All frontline employees should understand from participating in this training that LOSA is a voluntary program — they have the right to refuse being observed.

LOSA awareness training will demonstrate values to the employees through a circular process: (1) employees provide LOSA data by volunteering to become observers or to be observed; (2) employees informed how data are used and what changes have occurred; and (3) employees understand how LOSA benefits them at individual and organizational levels and become more motivated to participate. Thus, LOSA may create a domino effect (from observing the changes to making the changes) by positively leveraging peer pressure.

Training frontline employees may generate changes in safety culture. Safety cultures consist of shared beliefs, practices, and attitudes that exist in an organization. It is highly influenced by a number of factors such as employee training and motivation and employee involvement or "buy-in." Awareness training, along with a "kick-off" celebration, can be used to involve the entire site and announce it is a "new day" and seek buy-in for any new procedures and programs.

LOSA awareness training needs to address the following topics:

- Provide an overview of SMS and its safety programs (e.g., ASAP),
- Provide a general background of the M-LOSA & R-LOSA project and introduce the project website.
- Explain how LOSA fits with the other components of SMS.

Upon completion of the LOSA awareness training, participants should be able to

- Define LOSA,
- Understand the purpose of LOSA,
- Identify the goals of LOSA,
- Describe the characteristics of LOSA, and
- Outline the steps necessary to integrate LOSA.

TEM is the underlying framework of LOSA observations. Training on the TEM model can be likened to "defensive driving" for the frontline employees. Just as when on the road drivers exercise TEM-related techniques (e.g., being alert to other drivers on the road), frontline employees minimize safety risks by employing a proactive safety philosophy. Error management is considered to be a critical component of learning and adapting. Hence, training can increase awareness of TEM and result in better managed threats and fewer errors.

The TEM training should enable the participants to:

- Describe the TEM process,
- Describe what threats are and how to identify them,
- Describe what errors are and how to identify them, and
- Explain the different types of error outcomes.

It is highly recommended to use aviation examples to illustrate components and inter-relationships of the various components in the TEM model. In the sample training, Air Transat Flight 236, was used as a concrete example to explain the TEM model. Each organization should further customize TEM training to include events that are familiar to the training participants and specific to a particular operating environment where the target participants work.

Including the TEM component, the LOSA awareness training runs for less than one hour. The LOSA awareness training (including SMS and TEM) may be identical for both M-LOSA and R-LOSA programs. Participants to the train-the-trainer and observer training can join together for the foundational information, and then break away for the specific technical aspects of M-LOSA and R-LOSA observations.

Train-the-trainer training

The train-the-trainer training takes 16 to 18 hours over two to three consecutive days to complete. It should be conducted in person with hands-on observation and database practice, as well as a "teach-back" session.

Trainer selection criteria

It is generally agreed that face-to-face training is the most desirable, and CBT would be a minimum requirement for refresher training. LOSA train-the-trainer training should be a self-funded activity.

Minimum qualifications for trainer candidates are preferably:

- A technical training background in the area of the planned LOSA activity (e.g., maintenance or ramp), and
- Human factors experience.

Trainer candidates should be representatives from the aviation community. They should be subject matter experts with facilitation skills who can relate to the training attendees. Possible candidates for the trainers are experienced trainers at your organizations.

Refresher training for the LOSA trainers may be provided on an as-needed basis. Each organization will determine a proper frequency and monitoring system for refresher training as the M-LOSA and R-LOSA programs progress industry wide. One important goal of the trainer refresher training is to re-calibrate how they deliver LOSA training and conduct LOSA observations to maintain quality and consistency throughout the industry.

How to train the trainer

Once a LOSA trainer candidate is identified, the implementation team should send him/her a welcome letter detailing what to expect as a LOSA trainer about a month prior to the LOSA train-the-trainer training.

The train-the-trainer model reflects the theory that people who train others generally recall 90% of what they teach and that people often learn new information through trusted social networks. The model has been applied to different types of programs, in which a core group of people are provided with the skills and training to teach others about a specific

program or topic. The LOSA train-the-trainer training is essentially an expanded version of observer training with a "teach-back" session. How to conduct observer training will be explained in great detail in "Step 6: Observer Training" of this guideline. It is important to have a "teach back" session to make sure that the trainers understand and are capable of relaying their knowledge. The teach-back session is a way to confirm that the trainers understand the materials and can teach them back to an audience. This practice is expected to further enhance trainers' mastery of curriculum material. "Teach-back" is also known as the "show me" method or "closing the loop," which is one of the easiest tools with which to close the gap in training.

LOSA database training

The LOSA database training takes approximately two hours. It should be conducted in person with hands-on database practice. The trainer(s) should provide a stand-alone training database and a practice dataset, which could be loaded on (an) individual computer(s) for training purposes. This would allow a trainee to experience the inputs and outputs without affecting the data in a production database.

The LOSA database training should cover the following recommended topics:

- Logging in,[3]
- Getting help,
- Setting up accounts,
- LOSA observations, and
- Editing data from previous observations.

LOSA report training

The LOSA report training takes approximately one to two hours. It should be conducted in person with hands-on database practice. The trainer(s) should provide a stand-alone training database and a practice dataset, which could be loaded on (an) individual computer(s) for training purposes. This would allow a trainee to experience generating various reports.

The LOSA report training should cover the following recommended topics:

- Reporting capabilities,
- How to run generic reports, and
- How to run custom reports.

Refresher training

Observers should undergo recurrent training every 12 to 24 months to ensure they are calibrated with the LOSA standards. Table 5 outlines the contents, frequency, duration, and format of refresher training.

[3] Assuming a database administrator has already downloaded and installed the LOSA database.

Table 5. Recommended Refresher Training for Different Segments of LOSA Training

Specific LOSA Training	Contents of the Refresher Training	Frequency, Duration, and Format
LOSA Awareness Training	• M-LOSA & R-LOSA background • TEM • Brief ROI	Every other year; less than 1 hour; CBT
LOSA Train-the-Trainer	• Implementation process • Forms/Scenarios (Maintenance LOSA and/or Ramp LOSA)* • Database • Reporting • Q&A	Every other year; 4-6 hours; in person with hands-on observation and database practice and "teach-back" session
LOSA Observer Training	• Implementation process • Forms/Scenarios (Maintenance and/or Ramp LOSA) • Database • Observation protocol • Q&A	Every year or every implementation run (whichever occurs sooner); 4-6 hours; in person with hands-on observation and database practice
LOSA Database Training	• Maintain LOSA database • Customization • Q&A	Every other year; 2 hours; in person with hands-on database practice
LOSA Reporting Training	• Reporting • Q&A	Every other year; 1-2 hours; in person with hands-on database practice

*M-LOSA and R-LOSA programs have separate training packages. M-LOSA observer training has two variations: base maintenance and line maintenance. These training segments provide scenario-specific training for each work area.

Step 5c: LOSA Website

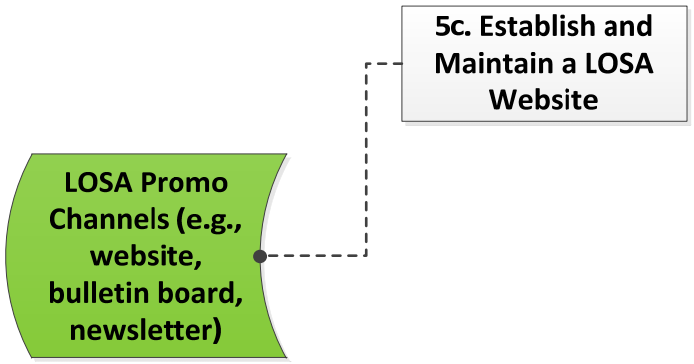

Figure 11. Recommended Refresher Training for Different Segments of LOSA Training

It is beneficial to create a virtual LOSA site or dedicate a section of an existing organization-wide virtual site to LOSA programs. This site can be used to promote awareness of the LOSA program, prepare the organization for LOSA observations, and present LOSA outcomes and action items to the workforce. A virtual site can also be used by the LOSA trainers, observers, analysts, the program manager, and others to store and distribute observation forms and training materials. Observers can submit observations via the site to a secured database. Analysts and the program manager can analyze and run reports on the site.

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TIPS:

- Instructors need to understand the difference between LOSA and other similar and dissimilar safety programs at a given organization.
- Each segment of LOSA training should start with clearly stated learning objectives. Desired learning outcomes should be reviewed at the end to summarize the training.
- Provide handouts for trainees to follow along and take notes, as well as review and reference after the training.
- CBT should be used to complement, not replace, in-person training.
- Document and share lessons learned from other LOSA programs and implementations, so the new implementation can be informed and prepared.

KEY REMINDERS:

- Ensure buy-in.
- Fundamentals are critical.
- Communication to everyone is critical.

FOR ADDITIONAL READING:

- Maintenance & Ramp LOSA training materials and templates are available at the "Training" section of the project website: www.MRLOSA.com
- Bloom, B. (1956). Bloom's Taxonomy of Learning Domains www.nwlink.com/~donclark/hrd/bloom.html
- Types of Questions based on Bloom's Taxonomy: www2.honolulu.hawaii.edu/facdev/guidebk/teachtip/questype.htm
- Clarke, D. (2009) Transfer of Learning: A brief and clear introduction - including an explanation of why transfer during a training event is important. www.nwlink.com/~donclark/hrd/learning/transfer.html
- FAA Human Factors: Training Transfer Online Reference: www.hf.faa.gov/webtraining/Training/Training023.htm
- Phillips, J. J. (1991). Handbook of Training Evaluation and Measurement Methods, Second Edition. Houston, TX: Gulf Publishing Company.
- Sierra, K. & Russell, D. (2005). Ten Tips for New Trainers/Teachers. headrush.typepad.com/creating_passionate_users/2005/07/ten_tips_for_ne.html
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Step 6: Observer Training

Observer selection criteria

LOSA observer candidates should possess the following characteristics:

1. Proficiency in the field they are observing (i.e., maintenance or ground operations).
2. Familiarity with the operating procedures. LOSA may help potentially identify a discrepancy between practice and standard operating procedures.
3. Respected frontline employees, but not a QA person. If a QA person were selected to be a LOSA observer, he/she might be able to switch roles from auditing to observing, but it would be difficult for the employees to switch their perception from the auditor function.
4. No permanent LOSA observers. They will be rolled back into their normal jobs to stay current with changing and evolving procedures and practices. Because of their LOSA observation experience, these staffs often become "safety advocates" in their work group. New observers also provide a fresh perspective and are likely to notice threats and errors that were previously overlooked.

Some organizations employ a selection procedure whereby management and the labor or employee group each put forth a list of acceptable observers, and selections are made from the personnel that appear on both lists. The observer team can include a small number of non-technicians or non–ramp employees, as long as they can anticipate and understand operational tasks and their surrounding context. However, the majority of the team should be active frontline employees.

The number of observers needed depends on the size of the assessment and the observers' workload. More data are better. Considering all the constraints, the LOSA implementation team should commit to drawing a representative sample of its fleet. There is substantial work involved in completing an observation form and providing detail-rich comments for each observation; therefore, an organization needs to commit adequate resources to conduct LOSA observations. Statistical formulas and web-based, sample-size calculators are available in the For Additional Reading section. You can use them to determine how many people you need to observe to get results that reflect the target population as precisely as needed. You can also find the level of precision you have in an existing sample.

In airlines that operate more than one base, observers should sometimes be scheduled to observe across bases other than their own, if the observers are known to the workforce at those bases. This adds value to the process in that the observer looks more at the "big picture" rather than the fine detail. For similar reasons, experience has shown that using a small percentage of external observers drawn from technicians with LOSA experience at other airlines adds value in the form of a "control group" for observations. External observers will normally attend the airline LOSA training and will need to familiarize themselves with airline procedures. They are particularly useful in picking up systemic and organizational threats to which airline staff are often "blind" due to familiarity.

How to train the observers

Required contents in the observer training should include the following segments. The first segment should provide learning objectives, a brief history of LOSA, TEM, how LOSA can be integrated into current safety programs, and lessons learned. The second segment should explain how to conduct observations through scenarios, and a minimum two-hour practice run in the hangar or shop, at the line, or on the ramp. Observers should practice with scripted scenarios or videos until they are confident they can use the observation form correctly. At this point, they can be dispatched to the hangar, line, shop, or ramp. During the practice observation, if there are any questions or doubts, observers-in-training need to immediately ask the trainers what to do and how to respond. It is recommended that observers be brought back in after one or two observations to discuss their observations, correct any misperceptions, and coach them on areas that require clarification. In the third segment, trainer(s) should lead the training class to review observers-in-training's observation notes and coding, discuss and explore questions and inconsistencies in observation and coding, as well as assess the inter-observer consistency. The fourth segment should focus on data entry, reporting using the database, and hands-on practice using a provided sample database or data collected from the practice run. At the end of the observer training (the fifth segment), the trainers should guide participants to review the learning objectives and assess if each of the objectives has been satisfactorily met and conduct a learning assessment. A learning curve should be expected. Usually, the first two segments and half of the third segment take place on training day one, while the rest take place during the second day's training.

Across different training segments, observer training should emphasize the following five topics:

1. LOSA Rationale and Etiquette

Observers will likely have a rudimentary understanding of LOSA when selected to conduct observations, but they will need to fully understand the safety rationale for conducting a LOSA at their organization. A "big picture" perspective will help observers understand the "why" of LOSA. Also, the observers will be ambassadors for LOSA while observing hangar maintenance, line maintenance, shop maintenance, or ramp operations. It is important that they can explain the process fully, answer any questions that the frontline employees may have, and address any apprehensions.

Specifically, the observers need to understand the safety rationale for normal operations monitoring — a discussion of predictive versus reactive and proactive safety strategies is recommended. The observers also need to know how the data collected from the LOSA will be used to understand strengths and weaknesses in the operations. An overview is recommended of the whole process from observations to data cleaning and analysis, to the diagnostic report, and the development of targets for enhancement.

Of course, the observers will also need to know the "how" of LOSA, specifically the etiquette associated with being a LOSA observer. An observer needs to learn how to approach a technician or a ramp employee, how to ask permission to observe a procedure, how to walk away so that the technicians or ramp employees can discuss it, and to accept without question any frontline employee's decision to deny the opportunity to observe. The observer can also carry a copy of the letter of endorsement jointly signed by management and the labor or employee group to show any interested frontline employee, if appropriate.

During a LOSA, the observer's behavior is best summarized as a "fly on the wall." The observer needs to be unobtrusive, yet responsive to any queries the technicians or ramp employees may have about the LOSA process. LOSA observers should be trained to accept their role as observers, not evaluators — they are NOT auditors. LOSA observers will observe errors and undesired states as part of their observations; however, they should only intervene if they know that the aircraft will not be airworthy or if aircraft damage or employee injury is about to occur. A helpful rule of thumb is to ask observers to think of themselves as a guest at another hangar, line, shop, or station. This helps distance the observer from the frontline employees, while still being able to politely point out airworthiness issues, potential aircraft damage, or potential employee injury concerns.

The LOSA observer is the only person in the LOSA process that will know the identities of the people who were observed, so it is essential that observers are reminded throughout the training of their responsibilities in this regard. Anonymity is paramount, and the observed employees' names should not be discussed with anyone, not even other observers. Experience has shown that at the end of an observation, technicians or ramp employees might ask the observer to "debrief" their performance. In these circumstances, it is essential that the observer politely decline the invitation. This emphasizes the concept that the observer is not there to evaluate the frontline employees, merely to record observations.

Experience at some organizations has shown the benefits of a post-observation discussion with the technicians or ramp employees. The sole purpose of this discussion is to gather additional demographic information and offer a two-way communication opportunity to clarify questions that either observers or the employees being observed may have. This discussion is voluntary, so maintenance technicians or ramp employees can refuse to answer any questions they do not feel comfortable addressing. In ramp LOSA, observers often have to stand far away from the frontline employees because of high activity levels, so the observers might miss some contextual details and cues. Immediately after each observation is the best time to speak with the frontline employees. A discussion after each observation may be a natural and polite way to end the observation. Please note the post-observation discussion is not an investigation. LOSA observations focus on observed threats and errors, and the post-observation discussion helps clarify the observable threats and errors. It is not intended to identify unobservable threats, but the post-observation discussion may reveal some relevant information that confirms the existence of unobservable threats.

The observers need to be trained and calibrated to carry out the post-observation discussion using a pre-scripted protocols. Ask the questions in a diplomatic way (e.g., when observing multiple ramp personnel not using knee pads ask, "Why do people not use knee pads at this station?" instead of "Why didn't you put on knee pads?"). An organization can decide if it wants to adopt the post-observation discussion based on its safety culture, communication style, and labor-management dynamics. There is certainly an advantage to gathering additional information. However, at some organizations, the post-observation discussion may be perceived as investigative consequently altering the non-punitive tone of LOSA and potentially killing the program.

In summary, LOSA observers should act in an unobtrusive and consistent manner so that technicians or ramp employees have a similarly positive experience with LOSA. This, in turn, will favorably affect their receptivity to the final results and outcomes.

2. TEM Concepts

Since TEM is the basis of LOSA, observers should be able to define, distinguish, and identify threats, errors, and undesired states. This is best achieved with a mixture of lecture, case studies, and review. Lecture material should include multiple examples of each type of threat, error, and undesired operational state. Case studies can take the form of scripted vignettes and/or actual accident and incident report excerpts. The distinction between threats, errors, and undesired states becomes clear with practice. Observers are usually able to correctly distinguish examples of all three categories in two days or fewer of classroom involvement.

3. Company Policies and Procedures

Observers need to be current with company policies and procedures so as to observe procedural adherence or deviations. Selecting active frontline employees from your organization is one way to ensure this. Spending some time in the classroom reviewing relevant procedures allows all observers to get "up to speed" on what they will be observing. Observers should also be encouraged to review the manuals, SOPs, and work cards as homework.

4. Observation Form

Each observer should be able to correctly complete and submit a LOSA observation form. Hence, observers should see the observation forms and threat or error codes as soon as possible after the training begins so that they have a clear sense of what is expected of them. With the observation form in hand, the observers can be led through the various sections, and then practice using scenarios.

If the observation form is software-based, time should be spent ensuring that all observers have the necessary computer skills to open the forms, enter and edit data, and submit the observation. Mastering these skills in the classroom will avoid potential loss of data later in the LOSA due to computer errors. Observers should have the name of an IT person inside their company to contact in the event of computer problems.

5. Written Description

Observers need training in writing comments. If they understand the concepts underlying the observation forms as well as the diagnostic rationale for conducting a LOSA, the observers will realize that good-quality comments are imperative. The observation forms should contain several prompts to help the observer provide sufficient detail, and observers should be encouraged to "overwrite" the observation, rather than provide too little detail. In particular, observers need to record threats, errors, and error outcomes, including the context in which they happened, and the frontline employee's responses. Observers are selected because they are experts at understanding maintenance or ground operations, and this expertise is best expressed in detailed comments. As long as the observer provides detailed comments of the observation, any coding oversights can be remedied later in the data-cleansing process (i.e., identifying incomplete, incorrect, inaccurate, irrelevant parts of the data and then cleaning this "dirty" data).

Observer standardization

Standardization refers to the need to be sure that observational details are recorded in a systematic and consistent fashion. In LOSA, standardization is a multi-step process that involves calibrating the observers and conducting follow-up data-cleansing and coding of completed observations. Both inter-rater reliability and intra-rater reliability need to be assessed.

The first step in any observer standardization is quality training. To be sure observers understand the concepts, group discussions are encouraged. Focusing on the finer points of the model and the observation forms can help calibrate the observers to a common standard. A test can be administered at the end of the training to ensure that all observers have grasped the necessary knowledge and can demonstrate the required competencies as specified by the training objectives. If observers complete this test satisfactorily, they can be released to the line to complete one or two trial observations.

The LOSA project manager or trainer should schedule time with observers to discuss their trial observations. If the observer is competent, as evidenced particularly by the quality of the coding and comments (notes), the observations can be retained and used in the LOSA, and the observer can be sent back out to complete observations. If the quality of the coding and comments is poor (e.g., inaccurate coding, lacking sufficient detail in comments), the trainer can work with the observer to help correct misunderstandings and draw out missing information. If the observer has forgotten details and cannot recreate the observation, the observation should be discarded, and the observer sent out to complete another trial observation. It is the LOSA coordinator's decision to drop any observer from the observation team if that person fails to meet the required standard. For this reason, it can be a good idea to initially recruit and train more observers than needed to allow for attrition, illness, and scheduling conflicts.

Handouts are recommended for training participants to take notes during the training and use as a reference in the future. The handouts should include a written protocol on how to conduct LOSA observations. For example, how to:

- approach peers at work, make introduction, explain the observation process, and ensure that everyone understands the non-punitive nature of the assessment;

- answer the typical questions from the frontline employees;
- obtain frontline employees' permission for conducting observations;
- physically position to best observe a maintenance or ramp activity; being a "fly-on-the-wall;"
- use scenarios to illustrate when to intervene;
- carry out a peer-to-peer discussion once a LOSA observation is completed.

Observers have to use the forms during the observation, even after becoming familiar with the process and contents.

The observer training takes approximately 16 hours to complete over two to three consecutive days. It should be conducted in person with hands-on observation and database practice. Upon completion of the LOSA observer training, an observer should be able to:

- knowledgeably and confidently explain the rationale and process for conducting a LOSA at the organization;
- enact the LOSA observer etiquette in a professional and consistent manner;
- understand the theoretical framework of the observation forms. If the tool is based on TEM concepts, the observer should be able to define, distinguish, and identify threats, errors, and undesired states;
- demonstrate knowledge of company policies and procedures;
- use the observation forms accurately and comprehensively;
- write detailed and comprehensive comments from which others will be able to understand the full context of the observation and related events.

Members of the LOSA implementation team may want to attend LOSA observer training at another organization or attend an industry-sponsored LOSA conference for further guidance before designing and customizing the training.

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TIPS:

- ✈ Make the training story-based. Engage trainees with practical examples, which add credibility to the instructors and training.
- ✈ Each segment of LOSA training should start with clearly stated learning objectives. Desired learning outcomes should be repeated at the end to summarize the training.
- ✈ Provide handouts for trainees to follow along and take notes, as well as review and reference after the training.
- ✈ Frontline employees have the right to refuse being observed, which cannot be used against them.
- ✈ Non-punitive nature of the LOSA program: Frontline employees should be informed on how their performance can be enhanced instead of being criticized and punished.
- ✈ Keep anonymous data collected and information obtained from each LOSA observation.
- ✈ Document and share lessons learned from other LOSA programs and implementations, so the new implementation can be informed and prepared.
- ✈ Direct LOSA observers to external resources, e.g., the project website.

KEY REMINDERS:

- ✈ Watch out for those things that may kill the program instantly:
  - ✈ Reporting threats and errors that are not imminent to the aircraft or personnel safety to management, which results in punitive actions in various formats to the frontline employees.
  - ✈ Set up and/or run LOSA that is too similar to other existing safety programs without unique safety or financial benefits; failure to address the incorrect perception of LOSA as an existing safety program in a different package.
  - ✈ Provide LOSA observers with written SOP for doing LOSA observations.
- ✈ LOSA is observation, not investigation or analysis

FOR ADDITIONAL READING:

- ✈ Maintenance & Ramp LOSA training materials and templates are available at the "Training" section of the project website: www.MRLOSA.com
- ✈ Bloom, B. (1956). Bloom's Taxonomy of Learning Domains www.nwlink.com/~donclark/hrd/bloom.html
- ✈ Types of Questions based on Bloom's Taxonomy: www2.honolulu.hawaii.edu/facdev/guidebk/teachtip/questype.htm
- ✈ Clarke, D. (2009) Transfer of Learning: A brief and clear introduction - including an explanation of why transfer during a training event is important.
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- www.nwlink.com/~donclark/hrd/learning/transfer.html
- FAA Human Factors: Training Transfer Online Reference: www.hf.faa.gov/webtraining/Training/Training023.htm
- How to Determine Sample Size: http://edis.ifas.ufl.edu/pd006
- Online Sample Size Calculator:
- Creative Research System: www.surveysystem.com/sscalc.htm
- Raosoft.com: www.raosoft.com/samplesize.html
- Phillips, J. J. (1991). Handbook of Training Evaluation and Measurement Methods, Second Edition. Houston, TX: Gulf Publishing Company.
- Sierra, K. & Russell, D. (2005). Ten Tips for New Trainers/Teachers. http://headrush.typepad.com/creating_passionate_users/2005/07/ten_tips_for_ne.html

IV. Active Implementation Phase

Step 7: Conduct LOSA Observations

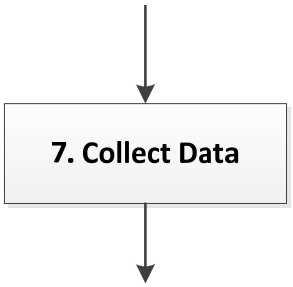

Figure 12. Step 7: Collect Data

A LOSA cannot succeed without the full and candid cooperation of the frontline employees, and there can be no cooperation without trust. In addition to LOSA awareness training, frontline employees should be informed in advance about the purpose and planned implementation of a LOSA. A letter co-signed by credible representatives of both management and labor to frontline employees is strongly recommended in order to assure them of the anonymity and non-jeopardy status of LOSA data. Such a letter should also include a disclaimer giving all technicians or ramp employees the choice of declining an observation at their discretion. Only by building in these guarantees and safeguards will the frontline employees feel sufficiently comfortable to act normally in the presence of a LOSA observer. A final assurance should be an in-house publication of a summary of LOSA results along with an outline of initial actions and proposed changes.

Plan a reasonable number of observations per observer per day to allow sufficient time to complete the observation coding and write detailed comments. Scheduling observers across stations and positions, regardless of their specialty, encourages a more general, cross-company perspective of frontline employee performance. Build some flexibility into the schedule to allow for the unexpected. Finally, do not let the observations continue indefinitely—schedule a set of observations within a 1- to 3- month period, if possible. The data needs to be assessed and actions implemented in a timely fashion. This is not to preclude using LOSA observations as part of the overall SMS set of tools and conducting if and when needed in your operations.

Carrying out an observation is a skill that can be learned and enhanced through practice. This section covers the following topics for both Maintenance LOSA and Ramp LOSA:

- Observation team
- Guidelines for how to conduct the LOSA observations
- Stages of LOSA observations
- Checklist for LOSA observations

Maintenance LOSA

The maintenance LOSA observation team

For Maintenance LOSA observations, we recommend one observer per task. However, for complex tasks, like an engine change involving several maintenance technicians, more than one observer may be needed. The one-person team certainly has many advantages. First, it is less intrusive and threatening to the maintenance technician(s) being observed. Second, due to the nature of some maintenance tasks, there is not much room for more than one person other than the working technician to stand and move around (e.g., cockpit, engine cowling). Third, viewing from a distance may not be possible (e.g., obstructed view or cannot see clearly until up close) or optimal (e.g., poor lighting or weather).

Two or more people conducting observations of a typical maintenance task could make the maintenance technician feel uncomfortable. The key to a LOSA observation is that you want the people being observed to quickly forget you are there. However, a two-person team, including a union observer, may be helpful at the initial launch stage of a LOSA program at unionized maintenance organizations. The union observer's presence is to let the maintenance technicians know that the union supports the LOSA program, which helps lower their apprehension, and helps ensure that they will behave as normally and as naturally as possible.

The observers who conduct LOSA observations should be carefully selected and properly trained in accordance with the training guidelines provided in this document. Additional training material is available via the project website (www.MRLOSA.com) and should be dovetailed into the material contained within this guideline for training staff.

After the initial introduction, during the field observation, observers must multi-task. First, they must observe how the technician conducts a given task, if he follows the SOPs or not, what the observable threats are, if and how those threats are managed, what the observable errors are, if and how those errors are managed, and what the error outcomes are. The observers must refer to the observation forms from time to time to ensure all observation items are captured. Second, the observer should mark in the observation forms coding and notes periodically. Third, the observer should take the "fly-on-the-wall" approach to be distant from the maintenance task being performed, and never intervene unless the aircraft will not be airworthy following the task, there is imminent personal injury danger to the maintenance technician(s), the equipment, or the aircraft airworthiness. Sometimes, maintenance technician(s) being observed may initiate conversations trying to understand more about the LOSA program or just to be friendly. However, the observer should politely re-emphasize it is important not to discuss the program specifics or engage in casual conversations during the observations, but carry out the task as if no other person were there. Only upon completion of an observation may the observer discuss with the technician(s) if there are any questions or suggestions. However, any suggestions to the technicians should be made using a strictly peer-to-peer, friendly and constructive tone.

Guidelines for the maintenance LOSA observation

Field observation is a common social science research method to study people and phenomena within natural settings. Field observation studies often vary in three ways: the amount of structure imposed on the observations, whether or not the participants are aware they are being observed, and the degree to which the observer interacts with the people in the setting.

The LOSA program adopts one type of field observation method called "direct (reactive) observation," which means that people know that you are observing them. One major problem with this method is that behavior may change because of the presence of the observer. Individuals may change their actions, rather than behave normally. Although people may alter their behavior when they know they are being observed, researchers often find that, over prolonged periods, people tend to forget or ignore that they are being observed and revert to their normal behavior. Thus, an observational study will eventually observe the natural behavior.

LOSA observers are trained to reveal the purpose of the observation but "lay back" and observe from a distance (not necessarily physical), with as little distraction as possible. However, because the LOSA program uses peer-to-peer observations, the observers are emotionally involved with the people in the work setting, although they can be trained to minimize that involvement. The LOSA observers should only ask questions of people in the work setting to gain a fuller understanding upon completion of the LOSA observation.

Stages of the maintenance LOSA observations

Stage 1: Prepare for the Field Observation

You may be provided with detailed instructions on how to proceed with the following four steps, or you may be asked to work with the LOSA program manager and other observers to make a cohesive plan together.

1.a Do your homework

The LOSA program manager may assign you a specific maintenance task to observe across multiple shifts over several days or weeks, or several maintenance tasks over the same period of time. Sometimes, as the subject matter expert, you may be consulted to suggest the most problematic areas or tasks to be the focus of a LOSA observation, the number of maintenance tasks to observe, and when or where to carry out those observations. Before each observation, determine what you are trying to learn (e.g., the most complained about and least paperwork-compliant maintenance tasks), and develop a clear mental image of the observation objectives. This will help you develop your observation plan and select what task (e.g., lock out and tag out procedure) and whom or where to observe.

1.b Plan for your field observations

For example, suppose you are to conduct observations related to how technicians currently lock out and tag out systems or equipment prior to performing a maintenance task. Depending on your focus, you may have a broad scope (e.g., do technicians run into any problems with lock out and tag out procedures in place?) or a narrow scope (e.g., particular tag and paperwork people that use to lock out and tag out).

Whatever your focus, you need to decide which segment of the maintenance task you need to observe (e.g., planning, removal, servicing) and print out the corresponding sections of the maintenance LOSA observation forms and review them carefully. Print out and review demographic, additional threats or errors, and acronyms sections of the forms, as well as

threat codes. It is also important to review any written standard procedures, manuals, or job cards for the given maintenance task.

Try to plan with an open mind and empathy for the technician(s). It is important to document the management or mismanagement of threats and errors, but even more importantly, you should try to understand the context in which such actions arose. Your decisions on whether the technician is doing the task correctly should be based on what is required by the maintenance documentation and not based on how you would perform the task or how you always thought it should have been modified or improved. During the planning stage, you should not look at yourself as a qualified maintenance technician at work but, rather, as an objective observer. In other words, let your knowledge, skill, and experience guide you in the interpretation of what you will observe, but do not let any preconception take over the observation.

1.c Select sites

The sites should be at places and times that are relevant for your observation objective. You should be able to observe without too much disturbance and without making the technicians at work feel self-conscious. The LOSA program manager should help you obtain the permission of management (and labor or employee group leadership) to access selected sites.

1.d Check into the sites

When you arrive at the sites, you should check in and obtain an acknowledgment from the supervisor and lead that you will spend a few hours walking around, observing the premises, and briefly talking to people afterwards. However, expect questions, especially if you are in an area you will not normally be in and walking around with a clipboard taking notes.

Stage 2: Conduct Field Observation

Approach the technician(s) you plan to observe, greet them, introduce yourself, and briefly explain what you are trying to do. They should already have been briefed on the LOSA process by this time. Ask for their permission to conduct an LOSA observation. Walk away so that the technicians can discuss it, and accept without question any technician's decision to deny the opportunity to be observed. It is recommended to carry a copy of the letter of endorsement jointly signed by management and the labor or employee group to show to any interested frontline employee. Thank the technician(s) if they agree to be observed. Explain that you may ask some demographic questions after the observation. You may also ask some clarifying questions about why somebody did something when the threats were not observable. However, the technician does not have to answer any questions he does not feel comfortable in answering. There are several options and a range of practices for obtaining feedback, e.g., seeking immediate feedback after each observation, or seeking cumulative feedback after a group of observations. The critical part is to involve frontline employees in discussing safety in a "peer-to-peer" atmosphere. Stress that the post-observation discussion is not any form of investigation; its sole purpose is to provide an opportunity for two-way communication to gain demographic data and to clarify any issues either you or the technician(s) may have.

Keep in mind your observation objectives. Keep an open mind and try to get a good idea or scheme of the actions that are taking place. If there are many people participating, make notes of what each one does and how they interact. Try to find out whether the actions occurring are normal or exceptional.

Remember, you may not see the threats that lead to the error(s). Never speculate or guess what the threats were during your observation. You must see, hear, smell, or touch a threat to confirm it. The safety information derived from LOSA observation data is only as valid as the data we collect. We want to avoid "garbage-in, garbage-out."

You should become very familiar with the observation forms as you use them over time. Use the forms as a checklist and refer to them from time to time. The forms are for a memory aid. You may get distracted or interrupted or become tired or bored, so do not solely depend on your memory during the observation.

Go through the forms before you conclude the observation to see if there are any fields that were left blank unintentionally. If there are items that you did not observe, were safe, or not applicable, mark them accordingly. You do not have to fill out all the fields (e.g., threat codes) if you do not observe the threat or activity; however, it is essential that all the mandatory fields in the demographics form are filled out.

It is always helpful to document some notes on the context of threats and errors. The notes will help you recall and organize your observation afterwards. They will be useful to the analysts to document your observations in the database and generate detailed reports. Write as many notes as you can. Take breaks to review and organize them.

Document your observation number. Check the "Did Not Observe" box if you did not observe a certain section. Write down additional threats and errors in the corresponding form. Make sure your handwriting is legible.

Keep an open mind, even if you feel people are doing things wrong. Try to understand why they are acting in a particular way. What knowledge or experience are they drawing on? What factors in their environment enable or encourage them to act in this way? What broader routine or purpose is this action part of?

Upon completion of your observation, make sure you have addressed all the questions you want answered. Ask the people on your observation team (if any) if they have anything they would like to add.

Remember to thank the people you have observed for their time. Tell them how to get in touch with you if they have any questions and leave them your contact information (if they do not already have it). Tell them what the next steps will be and how observational data will be used.

After your observation, go through your coding and notes in the observation forms, and write up additional notes as soon as you can. Remember to clearly label all material related to each LOSA observation.

Stage 3. Organize/Summarize Field Observations

Review your LOSA observation notes and finish incomplete coding as soon as practical. Because memory of details, dialogue, and the sequence of events fades fast, field notes are written as close in time as feasible to the observations. When unobtrusively observing from a distance, notes are written on the spot. There are always tradeoffs, as observers may risk missing something noteworthy while writing.

Key principles for the maintenance LOSA observation

There are some key principles to guide LOSA observations. These include:

1. Before each observation, determine what you are trying to learn and develop a clear mental image of the observation objectives. Print out and review all relevant observation forms and supporting documents.
2. Obtain and review any written standard procedures, manuals, job cards, etc. for the given maintenance task you are going to observe.
3. Take the "fly-on-the-wall" approach, and distance yourself from the maintenance task being observed.
4. Never intervene unless there is an imminent danger to the maintenance technician(s), the aircraft, the equipment, or if the aircraft is going to be left in a non-airworthy condition. If you see a technician carry out a part of a task incorrectly, and that error will make the aircraft non-airworthy, then you need to decide when to intervene. You want to give the technician time to recover from his error. On the other hand, if the technician does not seem to become aware of the error, you do not want to wait for him to finish a task and then have him backtrack for 30 minutes on the task to get to the error. Some judgment on your part will be required to decide when to intervene.
5. During LOSA observations, if maintenance technician(s) being observed initiate casual conversations with you, you should politely re-emphasize it is important to not engage in discussion but carry out the task as if no one else were there.
6. Document the management or mismanagement of threats and errors, as well as the context in which such actions arise.
7. To ensure the quality of data, never speculate or guess about what the threats were or whether other activities that you did not observe directly during your observation. You must be able to see, hear, smell, or touch a threat or activity to confirm it.
8. Use the LOSA observation forms as a checklist and refer to them from time to time.
9. Only upon completion of a observation, you may discuss with technician(s) if there are any questions or comments. A LOSA observation is not an investigation. The sole purpose of post-observation discussion is to gather additional demographic information to help you better understand or clarify things observed earlier.
10. Upon completion of your observation, go through your coding and notes in the observation forms, and write up additional notes as soon as you can.

Checklist for maintenance LOSA observations

Remember to prepare the following:

☐ Permission to observe in the location that you have selected (and separate permission for e.g., photographing)
☐ A plan of what and how you are going to observe and which people you should talk to
  ☐ An open mind – try to recognize and avoid preconceptions
  ☐ Pen and notepad with LOSA forms and supporting documents and sufficient paper for taking notes
  ☐ Camera or audio recorder (if they are a part of the LOSA program protocol at your organization)
☐ Your business card or the LOSA program manager's card or contact information so the people you have talked to can get in touch with you if they have questions or further information
☐ Personal safety protection gear (e.g., earplugs, goggles, hard toe shoes, reflective safety vest)
☐ Maintenance technician tools (e.g., flashlight)

Remember to do the following:

☐ Arrive on time and be well prepared
☐ Introduce yourself and explain why you are there
☐ Ask permission to do the LOSA observation

☐ Explain briefly how information collected will be used and toward what goal
☐ Do not disturb the people you are observing
☐ Look and listen closely and take notes
☐ Complement your observations with a short discussion only upon completion of your observation
☐ Ensure that the information will be used anonymously and kept safe
☐ Write up your notes and finish up coding right after each observation
☐ Make sure that all materials collected are labelled properly
☐ Dress properly and wear all required safety and security badges visibly

Ramp LOSA

The ramp LOSA observation team

According to the specific needs of your organization and a particular LOSA implementation, your company LOSA implementation team will decide whether your observations should be fleet specific, specific to a particular phase of the ramp operations, specific to an airport, or specific to an area of an airport. For each turn-around, a team of two or three observers is recommended depending on the type of aircraft (e.g., wide body, narrow body, turboprops, and regional jets) and the activities that you will be observing (e.g., you may decide not to observe the cleaning crew). The team can choose to divide observations during a turn-around by the areas of the aircraft (e.g., forward above the wings, aft below the wings) or by the specific tasks (e.g., lavatory/potable water service, catering, fueling), or a combination of the two (e.g., left of the aircraft during downloading, boarding bridge during arrival). The team members need to discuss and visualize a plan ahead of time regarding where each observer positions himself, and be open-minded and flexible during the observation. You may not find the best approach to coordinate observations right away, but it may take time through trial and error after three or four turn-arounds. To make the observation procedures more manageable, we recommend dividing the 14-section ramp LOSA observation forms into multiple sections; each observer is responsible for three to four sections (in another words, three to four ramp activities). However, make sure each observer has a copy of the demographic form, additional threat and error forms, and the acronym list. The bottom line is when there are multiple observers, based on a previously agreed-upon coordination plan, each observer should observe and record as much as possible. You want team members to overlap in their observations and notes to capture a comprehensive picture.

The observation team should try to be as least intrusive and threatening as possible to the ramp employees when they divide tasks and position themselves. The key to field observation is that you want the people being observed to quickly forget you are even there. A union observer may be helpful at the initial launch stage of a LOSA program at unionized airlines and ground operators. The union observer's presence is to let the ramp employees know that the union supports the LOSA program, help lower their apprehension, and help ensure that they will behave as normally and as naturally as possible.

A ramp LOSA observation can sometimes be a very demanding task because of the quick turn-around between the arrival and departure of a flight. To maximally assist the observation, the ramp LOSA observation forms were designed to use the checklist style for easy tracking plus some spaces for additional comments.

The observers who conduct LOSA observations should be carefully selected and properly trained in accordance with the training guidelines provided in this guideline. Additional training material is available via the project website (www.MRLOSA.com) and should be dovetailed into the material contained within this guideline for training staff.

After the initial introduction, during the field observation, each of the observers has to multi-task. First, he has to use all senses to see, hear, smell, and touch how the ramp employee(s) conducts a given task, if the standard operating procedures have been followed, what the observable threats are, if and how those threats are managed, what the observable errors are, if and how those errors are managed, and what the error outcomes are. The observer has to refer to the observation forms from time to time to ensure all observable items are captured. Second, the observer should mark in the observation forms with threat or error codes and notes periodically. Third, the observer should take the "fly-on-the-wall" approach and distance himself from the ramp task being observed, and never intervene unless there is an imminent danger to the ramp employees(s), the aircraft, or the equipment. Sometimes, ramp employee(s) being observed may initiate conversations trying to understand more about the LOSA program or just to be friendly. The observer should politely re-emphasize it is important not to engage in discussion but carry out the task as if no other person were there. Only upon completion of an observation, the observer may discuss with ramp employee(s) if there are any questions or suggestions. However, any suggestions to the ramp employee(s) should be made in a strictly peer-to-peer, friendly, and constructive tone.

Guidelines for the ramp LOSA observation

Field observation is a common social science research method to study people and phenomena within natural settings. Field observation studies often vary in three ways: the amount of structure imposed on the observations, whether or not the participants are aware they are being observed, and the degree to which the observer interacts with the people in the setting.

The LOSA program adopts a type of field observation method known as "direct (reactive) observation," which means that people know that you are observing them. One major problem with this method is that behavior may change because of the presence of the observer. Individuals may change their actions rather than behaving normally. Although people may alter their behavior when they know they are being observed, researchers often find that, over prolonged periods, people tend to forget or ignore they are being observed and revert to their normal behavior.

Ramp LOSA observation adopts a highly structured approach and use LOSA observation forms with a predefined set of categories of behaviors. Especially considering the quick turn-around between the arrival and departure of a flight, the ramp LOSA observation forms were written as multiple checklists with some spaces for additional comments.

LOSA observers are trained not to reveal their purpose of the observation but "lay back" and observe from a distance (not necessarily physical distance), with as little distraction as possible. However, because the LOSA program utilizes peer-to-peer observations, the observers are known by the people in the setting, although the observer can be trained to minimize that involvement. The LOSA observer should only ask questions of people in the work setting to gain a fuller understanding upon completion of the LOSA observation.

Stages of the ramp LOSA observations

Stage 1: Prepare for the Field Observation

You may be provided with detailed instruction on how to proceed with the following four steps, or you may be asked to work with the LOSA program manager and other observers to make a cohesive plan together.

1.a Do your homework

The LOSA program manager may assign your team a specific flight to observe across several days or weeks, or several flights over the same period of time. Sometimes you, as the subject matter expert, may be consulted for the most problematic areas or tasks to be the focus of a LOSA implementation round, the number of flights to observe, and when or where to carry out those observations. For each observation, plan out in advance what you are trying to learn (e.g., the most complained-about and least paperwork-complied ramp tasks), and develop a clear mental image of the observation objectives. This will help you develop your observation plan and select what (e.g., hearing protection misuse, including not use) and whom or where to observe.

1.b Plan for your field observations

Depending on your focus, you can have a broad scope or a more narrow scope. For example, you may want to conduct observations that are specific to how ramp employees currently use and misuse Personal Protective Equipment (PPE). In this LOSA, a broad scope can be how people misuse hearing protection such as earplugs on the ramp, or a narrow scope can include misuse of hearing protection such as earplugs due to communication needs.

Whatever your focus, you need to decide which segment of ramp tasks to observe (e.g., arrival, downloading, push-back) and print out the corresponding sections of the ramp LOSA observation forms and review them carefully. Print out and review demographic, additional threats or errors, and acronyms sections of the forms, as well as the threat and error codes. It is also important to review any written standard procedures or manuals for the given ramp tasks. Because ramp LOSA observations take place outdoors, we recommend you weatherproof your threat and error code cards by laminating them. Color-coding different groups of the threat and error codes will aid in your visual search. In addition, you may want to carry a pamphlet-sized one (folding an 8"x11" paper into half) out on the ramp, and keep a regular-sized (e.g., 8"x11", also color-coded and laminated) for office use. Instead of printing out ramp LOSA observation forms on 8"x11" paper and clip them on a clip board, some observers may find it more convenient to customize the size of ramp LOSA observation forms by reducing them and making a booklet.

Try to plan with an open mind and empathy for the ramp employees. It is important to document the management and mismanagement of threats and errors, but even more important, to try to understand the context in which such actions arise. Your plan should not include how you would perform the task or how you always thought it should have been modified or improved. During the planning stage, you need consider yourself not as a qualified ramp employee at work but as an objective observer. In another words, let your knowledge, skills, and experience facilitate you in the interpretation of what you will observe, but do not let them do the observation for you.

1.c Select sites

The sites should be places and times that are relevant for your observation objective. They should also be available and you should be able to observe without too much disturbance and without making the ramp employees feel self-conscious.

The LOSA program manager should help you obtain the permission of management (and union leadership) to access selected sites.

1.d Check into the sites

When you arrive at the sites, you should check in and obtain acknowledgment from the supervisor and lead that you will spend a few hours walking around, observing the premises, and briefly talking to people afterwards. However, expect questions, especially if you are in an area you would not normally be in and walking around with a clipboard taking notes.

Stage 2: Conduct Field Observation

Approach the ramp employee(s) you plan to observe, greet, and briefly explain what you are trying to accomplish, and ask for their permission to conduct a LOSA observation. Walk away so that the ramp employees can discuss it, and accept without question any employee's decision to deny the opportunity to be observed. It is recommended to carry a copy of the letter of endorsement jointly signed by management and the labor group to show any interested frontline employee. Thank the ramp employee(s) if they agree to be observed. Explain that you may ask some demographic questions after the observation. You may also ask some questions such as who the ramp employee was talking to on the headset. But do not ask people why they did or did not do some activity, because this will be threatening and take away from the feeling of anonymity. Ramp employees do not have to answer any questions they do not feel comfortable to answer. There are several options and a range of practices for obtaining feedback, e.g., seeking immediate feedback after each observation or seeking cumulative feedback after a group of observations. The critical part is to involve frontline employees in discussing safety in a "peer-to-peer" atmosphere. Emphasize the post-observation discussion is not any form of investigation; its sole purpose is to provide an opportunity for two-way communication to gain demographic data and to clarify any issues either you or the ramp employee(s) may have.

Keep in mind your observation objectives. Have an open mind and try to get a good idea or scheme of the actions that are taking place. If there are many people participating, make notes of what each one does and how they interact. Try to find out whether the actions occurring are normal or exceptional.

Remember, you may not see the threats that lead to the error(s). Never speculate about what threats caused an error during your observation unless you physically sense the threat yourself. The safety information we derive from LOSA observation data is only as valid and good as the data we collect. We want to avoid "garbage-in, garbage-out."

You should become very familiar with the observation forms as time goes by. However, use the forms as a checklist and refer to them from time to time. The forms are there to be a memory aid. You may get distracted, interrupted, or become tired or bored, so do not solely depend on your memory during the observation.

What is the true relationship between threats and errors? Threats can cause errors if threats are not identified and/or properly managed. For example, movable stairways may cause door damage. Errors can certainly cause additional threats. For example, soda bottles left on Ground Support Equipment (GSE) can become a Foreign Object Damage (FOD) threat.

Go through the forms before you conclude the observation to see if there are any fields were left blank un-intentionally. If there are items that you did not observe, were safe or not applicable, mark them accordingly. However, you do not have to fill out all the fields (e.g., threat codes) if you do not know what the threat was, for example. Double check all the mandatory fields in the demographics form are filled out.

It is always helpful to document some notes on the context of threats and errors. The notes will help you recall and organize your observation afterwards. They will be useful to the analysts to document your observations in the database and generate detailed reports. Write as many notes as you can. Take breaks to review and organize your notes.

Document your observation number. Check the "Did Not Observe" box if you did not observe a certain section of the observation form. Write on additional threats and errors. Make sure your handwriting is legible.

On a piece of blank paper, you may want to make comments and write additional notes detailing the overall observation. You may want to draw pictures of the airplane or GSE to help explain a point (e.g., which tire was not chocked). You may also want to document the number of equipment pieces that were used (e.g., two loaders, one food truck, and one lavatory service).

Do not skip the demographics section because demographics provide rich background and contextual information. As a part of preplanning, you and your observation teammates may want to discuss how to collectively gather demographics prior to, during, and after observations, so multiple observers observing the same flight will not repeat entering the same flight or personnel data.

Keep an open mind, even if you feel people are doing things wrong. Try to understand why they are acting in a particular way. What knowledge or experience are they drawing on? What factors in their environment enable or encourage them to act in this way? What broader routine or purpose is this action part of?

Upon completion of your observation, make sure you have addressed all the questions you want answered. Ask your observation team members if they have anything they would like to add.

Remember to thank the people you observed for their time. Tell them how to get in touch with you if they have any questions and leave them your or the LOSA program manager's contact information (if they do not already have it). Tell them what the next steps will be and how you will use the information they have given you.

After your observation, go through your coding and notes in the observation forms, and write up additional notes as soon as you can. Remember to clearly label all material related to each LOSA observation.

Please note, the current ramp LOSA program and observation forms do not cover the following ramp related activities and support tasks: bag room and sorting, cargo warehouse, mail sorting, quick pack, ticket counter, facility maintenance, GSE maintenance and repair shops, maintenance hangars, associated shops, etc.

Stage 3. Organize and Summarize Field Observations

Review your LOSA observation notes, and finish incomplete coding as soon as practical. Because memory of details, dialogue, and the sequence of events fades fast, field notes are written as close in time as feasible to the observations. When unobtrusively observing from a distance, notes are written on the spot. There are always tradeoffs, however, as these observers risk missing something noteworthy while writing.

Key principles for the ramp LOSA observation

There are some key principles to guide LOSA observations. These include:

1. Before each observation, determine what you are trying to learn, and develop a clear mental image of the observation objectives. Print out and review all relevant observation forms and supporting documents.
2. Obtain and review any written standard procedures for the given ramp task you are going to observe.
3. Take the "fly-on-the-wall" approach, and distance yourself from the ramp task being observed.
4. Never intervene unless there is an imminent danger to the ramp employee(s) at work or the aircraft or the equipment.
5. During LOSA observations, if ramp employee(s) being observed initiate casual conversations with the observer, you should politely re-emphasize it is important not to discuss the LOSA process or engage in casual conversations, but carry out the task as if no other person were there.
6. Document the management and mismanagement of threats and errors, as well as the context in which such actions arise.
7. To ensure the quality of data, never speculate about the threats or other information during your observation unless you see, hear, smell, or touch to confirm them.
8. Use the LOSA observation forms as a checklist, and refer to them from time to time.
9. Be non-judgmental. Only upon completion of an observation, you may discuss with ramp employee(s) if there are any questions or comments. A LOSA observation is not an investigation. The sole purpose of post-observation discussion is to gather additional demographic information and help you better understand or clarify things observed earlier. Do not ask the staff why they did something incorrectly or did not do something at all (like place a chock). This is not an investigation, and such questions will make the staff feel that they are being judged on their performance.
10. Upon completion of your observation, go through your coding and notes in the observation forms, and write up additional notes as soon as you can.

Checklist for ramp LOSA observations

Remember to prepare the following:

☐ Permission to observe in the location that you have selected (and separate permission for e.g., photographing)
☐ A plan of what and how you are going to observe, which people you should talk to
☐ An open mind – try to recognize and avoid preconceptions
  ☐ Pen and notepad with LOSA forms and supporting documents and sufficient paper for taking notes
  ☐ Camera or audio recorder (if they are a part of the LOSA program protocol at your organization)
☐ Your or the LOSA program manager's card or contact information so the people you have observed and talked to can get in touch with you if they have questions or further information
☐ Personal safety protection gear (e.g., earplugs, goggles, hard toe shoes, reflective safety vest, knee pads)
☐ Ramp employee tools (e.g., radio)

Remember to do the following:

☐ Arrive in time and be well prepared
☐ Introduce yourself and explain why you are there
  ☐ Ask permission to do the LOSA observation
  ☐ Explain briefly how information collected will be used and toward what goal

☐ Do not disturb the people you are observing
☐ Look and listen closely and take notes
☐ When it is possible, complement your observations with a short discussion with the employee but only upon completion of your observation
☐ Ensure that the information will be kept anonymous and safe
☐ Write up your notes and finish up coding right after each observation
☐ Make sure that all materials collected are labelled properly
☐ Dress properly and wear all required safety and security badges visibly

Please note that LOSA program does not replace other safety programs. It is unrealistic to think that a LOSA program will identify all threats or remove all risks or threats identified in the LOSA observations. For example, suppose a ramp LOSA observer observed an employee wearing inappropriate shoes, but according to the LOSA protocol, did not intervene. This employee continued wearing inappropriate shoes during and after the LOSA observation. This employee might get injured later, which posed a risk for the company. An organization needs to recognize what are acceptable risks that might be identified in the LOSA observations but would not be eliminated in the LOSA program. It is important to connect a LOSA program with other safety programs (e.g., ASAP), and establish a means to handle risks or threats identified in the LOSA observations in a non-punitive way.

Please refer to Appendix C for written protocols for LOSA observers. Appendix D lists some frequently asked questions about M-LOSA and R-LOSA programs.

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TIPS:

- ✈ Observers need to review any written standard procedures for a given task to be observed.
- ✈ Take the "fly-on-the-wall" approach.
- ✈ Never intervene unless there is an imminent danger to the employee(s), the aircraft, or the equipment.
- ✈ To ensure the quality of data, never speculate about the threats or other information during your observation unless you see, hear, smell, or touch to confirm them.
- ✈ Use the LOSA observation forms as a memory aid (i.e., checklist) and refer to them from time to time.

KEY REMINDERS:

- ✈ Expect a steep learning curve, and allow sufficient time for the observers to practice and calibrate.

FOR ADDITIONAL READING:

- ✈ Field observation materials and templates are available at the "Training" section of the project website: www.MRLOSA.com
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Steps 8-9: Validate LOSA Data & Populate Database

Before analyzing data, it is critical to first verify it by convening a meeting of local experts. There are several steps to ensure that LOSA data are consistently and accurately recorded before meaningful analyses can be conducted:

- Observers are trained, calibrated, tested, and recalibrated;
- Objective observation, not subjective evaluation, is the basis of the observation;
- The written description and comments are emphasized as key to high-quality data;
- The observers and/or analysts apply consistent coding to the observations; and
- The data verification group checks the analyst's coding against specific procedures.

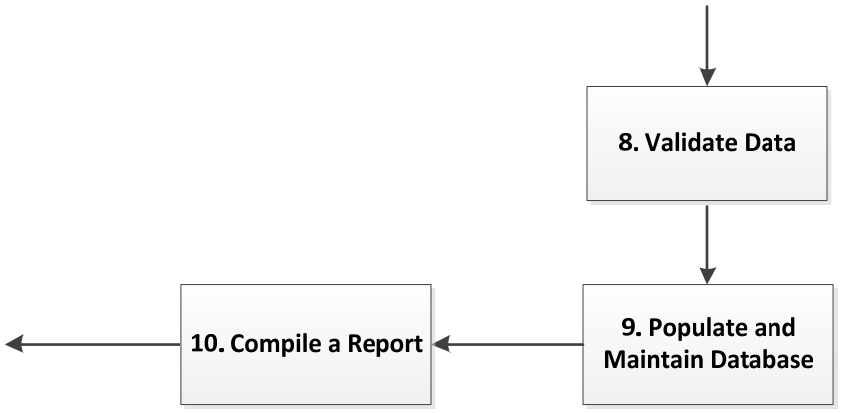

Figure 13. Steps 8-10: Validate Data, Populate and Maintain Database, & Compile a Report

LOSA data reveal strengths and vulnerabilities in an organization's operations. The data analyst should investigate the prevalence and management of different threats and errors. Although certain types of comparisons seem obvious, many analyses can and should be based upon hunches and theories derived from local knowledge of operations. If the analyst knows how fleets and operations are managed, comparisons that reflect this structure can be made. If the analyst knows the kinds of information that might be useful to training, safety, or to domestic or international flight operations, results can be tailored to these particular aspects of the operation.

Feedback from various stakeholders is critical during this stage of data analysis. The analyst should not hesitate to distribute early drafts to key people within the organization who are familiar with LOSA to cross-verify the results. This helps validate derived trends and gives other personnel ownership of information derived from the data.

Patterns emerge as the data are analyzed. Certain errors occur more frequently than others, certain airports or threats emerge as more problematic than others, certain SOPs are routinely ignored or modified, and certain maneuvers pose greater difficulty for adherence than others. These events and practices form the basis of suggested targets for enhancement.

Step 10: Compile a LOSA Report

The next stage in the LOSA implementation process is a written report that presents the overall findings of a given round of LOSA observations. With a large amount of observational data accumulated, it is easy to fall into the trap of trying to present everything. The report should be concise and present only the most significant trends from the data. Along with the results, the report should provide an initial list of targets for enhancement. Targets need to be data-driven and action-focused. Some example targets that might emerge from a LOSA include: Understand automation errors on the new fleet, investigate conditions at airports/stations X and Y, improve management of adverse weather threats, investigate high rate of Minimum Equipment List (MEL) items on the ABC fleet, and develop a module on intentional noncompliance errors for refresher training.

Generating reports with the LOSA database can be accomplished using Microsoft SQL Server Reporting Services or a similar reporting utility. Such services can be provided by a Business Analyst with Microsoft SQL Server, Microsoft Access, and reporting experience. Though not required, it is beneficial if business analysts for LOSA have a basic understanding of the aviation maintenance or ramp environments. If you wish to incorporate LOSA information with other

reporting tools available in your company, you should obtain the services of database administrators and business analysts familiar with your current systems.

The LOSA database tool provides a collection of predetermined ("canned") reports. The canned reports are limited in number and focus. They are generated by automatically extracting the data from the LOSA database and sending it to Microsoft Excel Pivot Tables. These reports can then be modified with any of the tools available in Microsoft Excel. The canned reports consist of:

1. All Cross-Reference Reports: All data from the database in one spreadsheet.
2. Threat Code – Totals Matrix: All reported threat codes and the frequency that they were reported.
3. Threat Codes by Effectively Managed: All reported threat codes and how they were managed.
4. Error Outcomes: All reported errors and whether the result was Inconsequential, Undesired State, or Additional Error.
5. Error Outcome by Observation Type: Error outcomes reported for each form (e.g., Install, Complete Restore).
6. Threat Codes by Error Outcomes: All reported threat codes and the associated error outcome (i.e., Inconsequential, Undesired State, or Additional Error).

Using the LOSA data

A well-conducted and well-analyzed round of LOSA observations identifies strengths and vulnerabilities in an organization's operations. It provides this information in a quantifiable form against which targets can be specified and improvements can be measured. The following example briefly illustrates the step-by-step integration of LOSA data into the safety change process:

(1) An airline's LOSA results indicated that two cowlings a month were being damaged because of leading edge device activation. Because observations were scheduled across the operations, and the number of observations exceeded 50, the LOSA implementation team was confident that the percentage is an accurate representation of operations as a whole.

(2) Following management briefings and extensive discussion, a target for improvement was created to reduce cowling damage incidents.

(3) An action committee was formed to conduct a focused LOSA to determine the cause of the damage. The focused LOSA revealed that the lock-out tag-out procedures were being incorrectly executed. A contributing factor was lengthy procedures. The committee found that it was possible to lock out and tag out the leading edge devices safely with fewer steps. The new procedure was implemented.

(4) A LOSA was repeated 6 months after the first LOSA. The data, once aggregated and analyzed, showed cowling damage incidents from leading edge device activation had been reduced by over 90%.

Data from a particular LOSA program can be cross-referenced with data from the ASAP and/or QA audit programs. That would depend on the sophistication of an organization's SMS and the extent to which various safety programs within the organization can cooperate. Each data source provides unique yet complementary evidence of the company's safety status. In the above example, the organization might track cowling damages through its QA audit program. New maintenance procedures could then be implemented into procedures and training. To see if technicians are incurring problems with the new procedure, the QA data can be cross-referenced with ASAP reports of events resulting from lock-out tag-out procedures. This way, the organization does not have to wait until the next LOSA to learn if its interventions are successful.

LOSA data are useful in another way. LOSA presents a broad view of operations. A repeat LOSA can maintain that broad focus. For example, did the changes that were introduced after the first LOSA improve results in one area, only to cause problems in another? Checklist adherence may have improved, but did error detection, the superordinate goal of improving checklist adherence, actually improve? Or, is the new adherence simply cosmetic?

In summary, the data collected during a round of LOSA observations can be used to achieve many goals:

a. ***Identify threats in the organization's operating environment***. Observers note events in the operational environment (e.g., adverse weather, incomplete documentation, time pressure, and how they are managed by frontline employees). High-prevalence threats and/or threats with higher mismanagement rates can be prioritized for further investigation; lower mismanagement rates signify areas of strength. For example, LOSA can promote an understanding of the extent to which certain procedures pose a problem for frontline employees. LOSA can capture the strategies that frontline employees have adopted to deal with the challenges. Then it can lead an organization to develop special procedures or advisories to help its employees manage the known threat.

b. ***Identify threats from within the maintenance or ramp operations***. Observers note events arising from within the organization's own operations and how they are managed (e.g., operational time pressure, dispatch errors, aircraft malfunction/ MEL items, and problems with interruptions, other personnel, and the ramp). A high number of threats

arising from dispatch or parts might signal that these departments require attention. It could reveal challenges with intergroup cooperation with frontline employees or that procedures are inconsistent across departments. As above, prevalence and management rates provide cues for prioritizing action.

c. ***Assess the degree of transfer of training***. Data provided by training programs can provide insight on whether training concepts are learned but not whether they are actually practiced. A LOSA provides that operational information. LOSA can be reviewed from a training perspective to understand which areas of training, if any, are not successfully transferred.

d. ***Check the quality and usability of procedures***. A LOSA provides insights about potential problems with procedures. For example, if 5% of observed technicians fail to properly lock out and tag out, there may be a problem with those technicians. However, if 50% of observed technicians make the same error, then the evidence suggests a problem with the procedure. Procedures can be ill-timed, overly-long, confusing, ambiguous, and/or compete for the technicians' attention with other more important activities. A LOSA will locate problematic procedures and policies via poor adherence rates. A LOSA can also identify the extent of procedural deviations across fleets.

e. ***Identify design problems in the human/machine interface***. A LOSA captures aircraft design and reliability problems on different fleets that can highlight systemic flaws in design, interface, or adaptation. The rate at which certain errors go undetected and become consequential can also indicate potential design vulnerabilities. An airline can feed these LOSA findings back to the aircraft manufacturers, as well as use findings to write Standard Operating Procedures and other technical documentation.

f. ***Understand frontline employees' shortcuts and workarounds***. With experience comes expertise; frontline employees learn ways to save time and be more efficient. These techniques are rarely seen in a traditional audit, when performance is usually done by the book. A LOSA provides an opportunity for the organization to capture collective expertise from within the frontline employee group, and then share that information with all its employees through formal organization communication channels. Using LOSA, false expertise — the adoption of a shortcut or workaround that is flawed in its safety assumptions — can also be identified and remedied. Shortcuts or workarounds indicate that frontline employees were often aware of a problem in existing operational procedures.

g. ***Assess safety margins***. Threats and errors that are mismanaged can result in undesired states, if sufficiently serious. A LOSA provides data about the prevalence and management of these incident and accident precursors. Thus, an organization acquires data about how closely it is operating to the edge of the safety envelope, without crossing the boundary into an incident or accident.

h. ***Provide a baseline for organizational change***. LOSA results provide baseline and outcome measurement data against which organizational interventions can be measured. Using a medical analogy, this is akin to a patient deciding to cut out fried foods upon learning of a high cholesterol count. The next checkup reveals, in quantifiable form, whether this strategy has been effective in reducing cholesterol or whether other actions are necessary. Similarly, a follow up LOSA provides a new set of results that will show whether the organizational changes were effective in reducing certain threats, errors, and/or undesired states.

i. ***Provide a rationale for allocating resources***. Because LOSA results highlight the weaknesses as well the strengths in an organization, the results provide a data-driven rationale for prioritizing and allocating scarce organizational resources toward interventions.

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TIPS:

- Document and share fact-based data to illustrate benefits from LOSA efforts.
- Use the information — create action plans, implement changes, and evaluate results.

KEY REMINDERS:

- Consistency is essential.

FOR ADDITIONAL READING:

- Microsoft Online Reference for SQL Server: www.microsoft.com/sqlserver/en/us/default.aspx
- SQL Training for Beginners. Online Reference: www.sqlcourse.com/index.html
- FAA. (2006). Advisory Circular: Line Operations Safety Audits (AC 120-90): Federal Aviation Administration.
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Step 11: Feedback to the Employees

Figure 14. Step 11: Feedback to Employees

It is critical to give the employees feedback on all LOSA observations.

First, brief the management and labor leadership about what has been learned and action items derived from the initial round of LOSA observations. The LOSA report should be presented to management in maintenance or ramp operations, training, standards, safety, and possibly other departments, depending on the results. For example, representatives from flight operations, dispatch, and cabin may want to hear how their work is perceived from the LOSA observers' perspective, particularly if it is problematic. A briefing to the union or employee group, as applicable, is also recommended. Once the various departments are briefed on the report, they will likely want to investigate the data more deeply themselves. The data should be available in aggregate form for them to review. Some of the more detailed LOSA comments will also be of interest, so make sure to de-identify those observations before distributing aggregate LOSA summary and comments.

Second, and most importantly, brief the frontline employees. Technicians and ramp personnel should also be informed of the significant results in the LOSA report. To sustain the frontline employees' interest in the LOSA project, make an announcement at the end of the data collection phase that the LOSA observations have been completed. The early report can simply state how many LOSA observations were completed and on which fleets, and advise the workforce when to expect the results. When the report is ready, the highlights should be presented to the frontline employees, either as one LOSA debriefing event, spread over time in the organization newsletter, or other safety periodical, or other channels of communication, such as safety bulletin boards or a LOSA website. Frontline employees will want to know what changes will be undertaken as a result of the LOSA, and they should be a part of the change. All reporting should be timely and not held back by the long list of communications and legal personnel, who are often insensitive to the timeliness of information dissemination.

Third, after the management, labor leadership, and frontline employees are informed of LOSA findings, it is critical to continuously monitor the safety change process through implementing and monitoring actions resulting from the LOSA observations. Historically, organizational safety changes within aviation organizations have been driven by

accident/incident investigation and intuition. Today, organizations must deal proactively with accident and incident precursors. To be successful, the safety change process must be data-driven.

Measurement of daily operations is fundamental because unless an organization uses systematic measurement, the perspective it has on the strengths and weaknesses of its operations is largely based on anecdote and opinion. A LOSA implementation provides specific and quantified results. To take full advantage of this specificity, the targets for enhancement that arise from the data analysis should go through a formal safety change process to improve. A formal safety change process provides a principled approach to target limited resources and helps the organization avoid turf issues by clearly defining and prioritizing the issues that impact maintenance or ramp operations. The basic steps of a safety change process include:

1. Communicate with all employees at every step,
2. Measure (with LOSA) to obtain the targets,
3. Perform detailed analysis of targeted issues,
4. List potential changes for improvement,
5. Assess risk and prioritize changes,
6. Select and fund changes,
7. Implement changes,
8. Allow time for changes to stabilize, and
9. Re-measure.

Once your organization has done an initial LOSA, a critical question is when to conduct the next one. LOSA data provide a baseline against which to measure improvements. A realistic timeframe to review LOSA results, develop and implement action plans, and monitor results is six months to one year. Hence, to measure the effectiveness of organizational changes, a repeat LOSA every six months to one year is recommended.

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TIPS:

- ✈ Communicate the LOSA results in a timely manner.
- ✈ Use the information — create action plans, implement changes, and evaluate results.

KEY REMINDERS:

- ✈ Consistency is essential.

FOR ADDITIONAL READING:

- ✈ Strategic Employee Communications: Solutions that Influence Behaviors and Attitudes. Online Reference: www.ketchumperspectives.com/archives/2004_i2/internal/strategic.php
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V. Continuous LOSA Application Phase

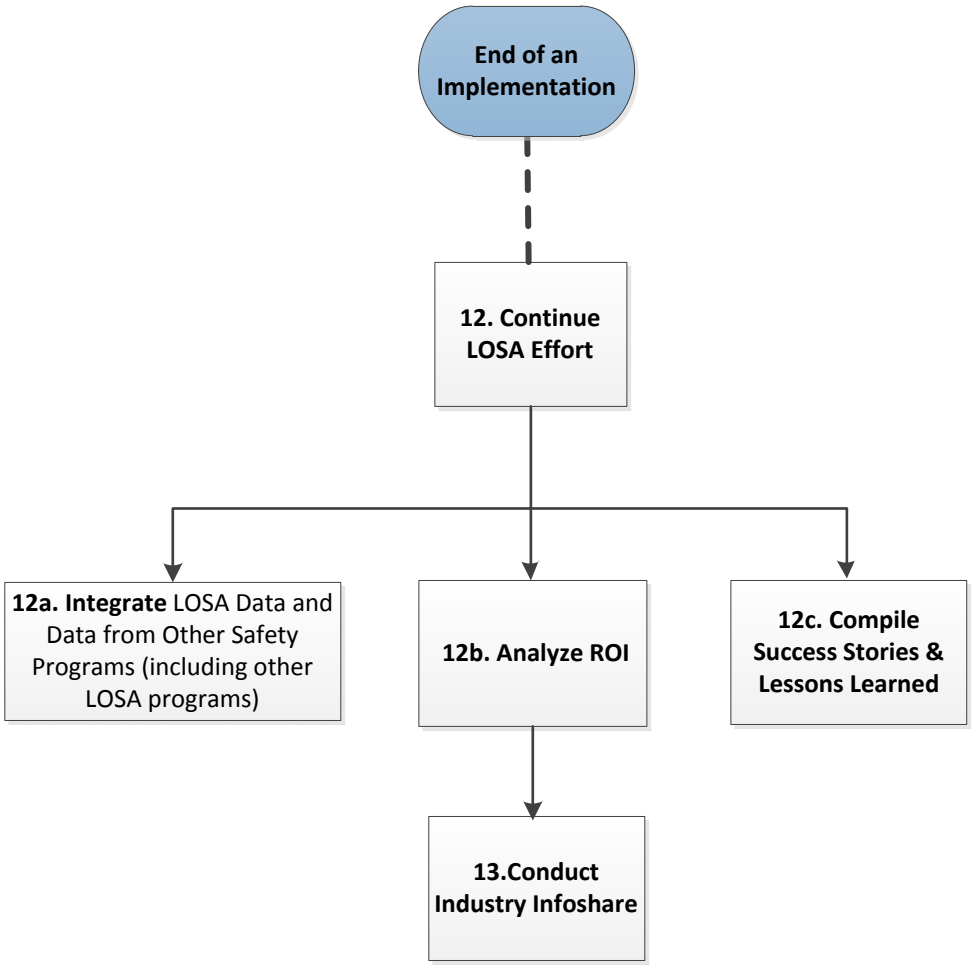

Figure 15. Steps 12 & 13 : Continue LOSA Effort and Conduct Industry Infoshare

Step 12a: Integrate LOSA Data and Data From Other Safety Programs

The TEM model applies at different levels and sectors within an organization and across different organizations within the aviation industry. For example, to enhance aviation safety and efficiency, International Civil Aviation Organization (ICAO) (2005) introduced the TEM framework and TEM-based tool called Normal Operations Safety Survey (NOSS) to the Air Traffic Services community, and the Air Traffic Control (ATC) community in particular. According to ICAO (2005), NOSS is intended to furnish the ATC community with a means for providing robust data on threats, errors, and undesired states. NOSS data and safety data from conventional sources should focus the safety change process on the most critical areas. The TEM framework helps make operational personnel's implicit awareness of the threats explicit and principled, and therefore manageable. Dispatch Operations Safety Audit is an adaptation of the LOSA methodology and the TEM model to airline flight dispatch operations (FAA, 2006). Transfer of LOSA methodology to other areas eventually helps provide a 360-degree perspective on interactions between various aircraft entities (FAA, 2006). These previous transfers of LOSA echo the importance and timeliness of extending LOSA effort into aviation maintenance and ramp operations.

Complement existing safety programs in SMS

Safety reporting is one element of SMS SRM implementation. The SRM function provides for initial identification of hazards and assessment of the hazards for risk. Organizational risk controls are developed, and once they are determined

to be capable of bringing the risk to an acceptable level, they are employed operationally. Consequently, employee reporting processes and systems are an essential ingredient in identifying known safety hazards in an organization to fulfill the SMS SRM requirement.

Robust SMS employee reporting programs will have multiple layers of employee safety reporting processes that may include Event Reporting, ASAP, and LOSA programs. While identifying every conceivable hazard would be unlikely, aviation service providers are expected to exercise due diligence in identifying significant and reasonable foreseeable hazards related to their operations. The SMS framework specifies that the aviation service provider must provide for a means of employee communication that allows timely submission of reports on safety deficiencies and clear lines of communication both up and down the organizational chain regarding safety matters. Employees must be encouraged by top management to use the employee reporting system without fear of reprisals. Data from the safety reporting and feedback system (LOSA, ASAP, Event Reporting) should be monitored to identify emerging hazards. Despite the program differences, data from one program can be cross-referenced and used to guide data collection in another. For example, ASAP reports may highlight a problem with lock-out and tag-out (LOTO) procedures. This information can be given to the LOSA implementation team, which can then target more observations on LOTO to understand the magnitude and specifics of the problem.

As a part of SMS, the organization must continuously measure the effectiveness of the SMS and of safety risk controls through the use of the safety and quality policies, objectives, audit and evaluation results, analysis of data, corrective and preventive actions, and management reviews. LOSA is one of the tools that allow organizations to meet this requirement. Effective LOSA data mining and trending provide the means for assessing root cause analysis, and taking effective, mitigating actions with changes to policies, procedures, equipment, and tooling. Consequently, it is essential with any LOSA program integration that an electronic data collection system be deployed that allows for an effective and timely data analysis process. This is a key ingredient with any of the employee reporting systems that are ultimately integrated into the SMS.

LOSA integration into an organization should be considered only as one of several key employee reporting programs that provides a continual data stream of frontline operational data to the airline. LOSA data, coupled with data from other employee reporting programs such as ASAP and Event Reporting, can be a powerful tool in defining operational hazards and allowing for timely risk mitigating actions that can lower risks and improve the overall safety environment of the airline.

Step 12b: Analyze Return on Investment (ROI)

LOSA can help ensure continuing safety, reduce operating costs, and make a significant contribution to identifying predictive indicators for the overall safety management system. These statements seem obvious. However, it is best when such intuitive statements are supported with data. It is possible and relatively straightforward to measure the effect of the LOSA and resulting interventions. It takes organizational commitment to use existing data to show the impacts on financial and safety bottom lines.

The term, ROI is rooted in finance. In the simplest sense, it is a basic math problem of comparing the amount invested to the amount returned (i.e., Return over Investment) during a specified time period. Of course, you must subtract the amount invested from the return before you divide the return by the investment. Figure 16 shows the basic ROI model. This section is not meant to be a treatise on ROI but merely makes the point that such calculations are feasible.

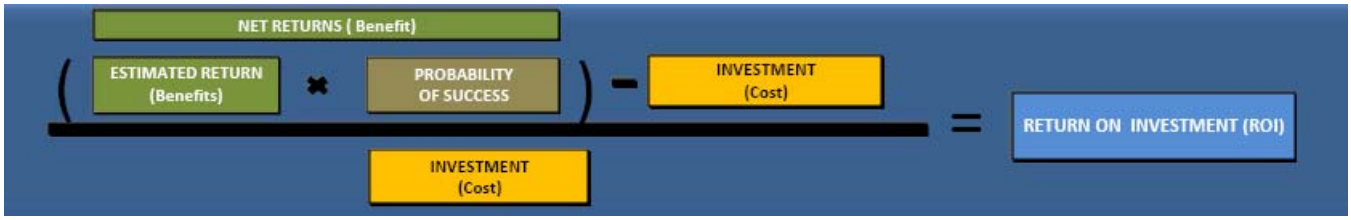

Figure 16. The Basic Return on Investment Model

The scenario below is a fictitious example of an ROI calculation of an issue discovered by LOSA. Because it was not fully proven, it was necessary to estimate that there was a 0.6 probability that the intervention identified by LOSA would actually work. The calculation is based on that estimate.

In one month, an airline encountered over 100 additional 30-minute gate delays because technicians could not process accurate maintenance documentation in a timely manner.

A set of targeted LOSA observations showed:

- Line maintaining technicians spent excessive time citing all the maintenance manuals and appropriate job cards in the return-to-service paperwork.
- Flight crews often rejected packages because they "seemed incomplete."
- Airworthiness and safety were never in question, but regulatory compliance was often the issue causing a delay.
- Flight-line technicians complained that they often were too far away from documentation terminals and printers.

The estimated ROI was calculated in the following manner:

- Manufacturer's estimate was $6,000 per hour of gate delay for narrow-body aircraft.
- One hundred 30-minute delays cost $3.6M per year (600 hours of delay/year x $6,000/hour).
- Maintenance analysts determined a way to transmit the most commonly used forms and job cards to portable computer/printers for flight lines in the four selected hubs.
- The cost for the implementation was estimated to be about $500,000 per hub for hardware installation, testing, and implementation.
- The airline planned to invest in the system for an additional $500,000 in each subsequent year.
- The analysts estimated that these new systems would eliminate about 60% of the delays (.6 probability of success). Table 6 shows the ROI for a three-year period.

Table 6. Three-Year ROI for Airline Documentation Example

First Year
((3,600,000 x.6) - $2,000,000)/ $2,000,000 = ROI = 8%

Second Year ($500,000 added for support)
((7,200,000 x .6) – 2,500,000)/$2,500,000 = ROI = 73%

Third Year ($500,000 added for support)
((10,800,000 x.6) – 3,000,000)/ $3,000,000 = ROI = 116%

The example calculations demonstrate how to use the simple formula. The calculations do not reapply the return to subsequent support investment, escalate the cost of error, or consider the time value of money. A serious economist and team of maintenance and engineering analysts would apply appropriate estimates and probabilities to each intervention. However, this example shows that even simple ROI calculations can make the point.

The financial calculations are more straightforward than the safety calculations. It is challenging to place concrete costs on safety. Therefore "Safety" is less conducive to ROI calculation than the many interventions that may save money. A reasonable assumption is that, as LOSA identifies and corrects threats in an organization, it also affects safety.

ROI cautions

Start slowly, taking small steps. Use the LOSA ROI calculation on many small interventions. Determine the validity and reliability of your estimates on the small projects before proceeding to the large projects. If you are making ROI calculations, in advance of interventions, be thoughtful and analytic as you estimate the probability for success. Early success on the small projects will build not only your predictive accuracy but also will establish corporate trust in your ideas for new interventions to ensure safe and efficient human performance. However, please note accuracy often changes when moving from the simple to more complex projects when the interactions of multiple variables are encountered.

FAA tools for ROI

The FAA offers a process and software to assist with ROI calculations. It was originally designed to assess the ROI on interventions related to human fatigue. However, the model (identical to the description above) is generic. The tool is designed for mid-level managers rather than financial analysts. It sets the foundation to assess the value of the many interventions that can result from ramp and maintenance LOSA programs. The software is available at www.mxfatigue.com.

Alternatives to LOSA ROI calculations

It is not always necessary to perform calculations to justify a LOSA program or the process and product improvement interventions that may result from LOSA. Organizations have plenty of Key Performance Indicators (KPIs) that can demonstrate the impact of LOSA. Since KPIs are influenced by many factors, it is important to delimit topics to be sure that a KPI change is really attributable to a LOSA.

There are many methods to show the value of LOSA. Because LOSA identifies specific weaknesses or can highlight excellent processes, it is possible to assess impact. LOSA is an answer to the adage "If you can't measure it then you can't improve it."

Step 12c: Success Stories and Lessons Learned

It is critical to document some success stories and lessons learned of M-LOSA and R-LOSA. At times it can be difficult to obtain approvals from an organization's Legal/PR/Corp Communication Departments to publish and distribute the fact-based examples. As discussed in Section 2.1, senior management's continuous commitment will be critical to write success stories using fact-based data.

M-LOSA

At Airline ABC, M-LOSA findings help to make deactivation procedures more workable, efficient, and safer. As an example, 767 leading edge device deactivation and reactivation procedures took three hours to properly tag out without individual sign-offs. An M-LOSA auditor identified this inefficiency, which was then addressed by Tech Publications by rewriting their deactivation/reactivation procedures. Now, with individual sign-offs, this modified process takes between 30 and 45 minutes to complete. The new procedures also help to standardize the process to avoid problems caused by shift changes (deactivation and reactivation are often carried out on different shifts) and interruptions. This deactivation/reactivation procedure has been implemented in the entire fleet. Because of the changes implemented by M-LOSA, the threats have been reduced tremendously, and no damage to the aircraft has occurred since.

Reasons the lockout and tag out process previously took so long involve unnecessary deactivation of some systems. Lock-out and tag-out of the leading edge devices in the Aircraft Maintenance Manual (AMM) is 37 pages long. Some steps required multiple section reviews between different sections of the AMM. The new workcard that emerged from M-LOSA is two pages long with different steps clearly listed. There are no individual sign-offs following the AMM (e.g., deactivate the slats per AMM 27-XXX).

As another example, a previous norm was that there was no huddle (briefing) before the pushback of ground equipment. M-LOSA identified that the person who needs to take responsibility for the huddle is the maintenance technician in the cockpit.

R-LOSA

In 2008, among 447 problems identified by flight ops LOSA at Airline ABC, 147 (29%) were ground safety issues. An examination of flight ops LOSA archival data revealed that the industry average is only 16% for flight ops ground safety issues.

To improve ground safety performance, Airline ABC has established several safety programs under the umbrella of its SMS; for example, the Safety Recognition Program. Station #1 has the same ground safety programs as Station #2 and added the R-LOSA program. Both stations improved their group safety performance dramatically over a three-year span. Note that the actual data for the third year are only available from January through October. Monthly averages for the first 10 months were used to estimate November and December ground damage mishaps, and consequently, the averages for the entire year. However, the improvement observed by Station #1 was more than Station #2, which can be potentially attributed to the effectiveness of R-LOSA program (Note that Station #1's initial safety performance was better than Station #2). Ground safety performance was assessed using three measures: (1) total number of ground damage occurrences; (2) ground damage mishap rate per 10,000 departures; and (3) cost of ground damage mishaps.

Ground operation mishaps can be further categorized as attributable mishaps and non-attributable mishaps. Attributable mishaps are a result of human error and will be charged back to the responsible department or vendor. Non-Attributable Mishaps include FOD. The costs are not recovered for these mishaps. Both stations showed a dramatic decrease in the total number of ground damage mishaps over the three-year span. The number of attributable and non-attributable mishaps for Station #1 dropped 73% and 85%, respectively, whereas the drops for Station #2 were 58% and 67%, respectively. The cost of ground damage also decreased at both stations over the three years.

Per every 10,000 departures, Station #1's attributable ground damage mishaps dropped 61%, and non-attributable mishaps dropped to zero over the three years. For Station #2, both attributable and non-attributable mishap rates decreased

43% and 45%, respectively. The most significant improvements were observed in the following four areas: ground handlings ops, struck by vehicle in motion, taxi-tow-push, and maintenance operations.

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TIPS:

- Calculate ROI to measure and quantify success.
- Document, communicate, and share fact-based data to illustrate the benefits of LOSA effort.
- Document, communicate, and share lessons learned.
- Use the information—create action plans, implement changes, and evaluate results.

KEY REMINDERS:

- Consistency is essential.

FOR ADDITIONAL READING:

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- ASSE White Paper Addressing the Return on Investment for Safety, Health and Environmental (SH&E) Management Programs www.elcosh.org/en/document/63/d000047/asse-white-paper-addressing-the-return-on-investment-for-safety%252C-health-and-environmental-%2528sh%2526e%2529-management-programs.html
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VI. Critical Success Factors for a LOSA Implementation

In summary, here are five critical success factors for a LOSA implementation:

(1) Senior Leadership Support and Drive for Change

Senior management commitment is vital for the success of a LOSA program and key to initiating the drive to change the organization in line with LOSA results. This commitment must be expressed in behavior and with financial support to ensure success of the program. Leaders must understand the process and its purpose to be able to communicate the value.

(2) Early Stakeholder Engagement

Experience has shown that engaging stakeholders (including those who are likely to receive LOSA findings) early in the LOSA development is more likely to lead to acceptance of LOSA data and findings and, thus, safety culture change. By gaining an early understanding of what LOSA is and how it works, the stakeholders will be more likely develop ownership for the program's development and success. Stakeholders may include representatives from various functions such as training, operations, communication/marketing, union/labor groups, the regulators, and vendors.

(3) Communication and Promotions

Promotion and awareness training prior and during a LOSA implementation is essential to facilitate awareness and acceptance by the general workforce. At the conclusion of an assessment period, results and initiatives of the LOSA must be communicated to the operational community and relevant business functions such as the training department. This is an important step as it demonstrates the organization's commitment to safety change to the frontline employees, thereby increasing their trust in the LOSA process for the next assessment.

(4) Non-jeopardy Observations

LOSA implementation must follow the 10 operating characteristics that define the integrity of the LOSA process and the quality of LOSA results (FAA, 2006). Ensuring that observations are not used for disciplinary or performance management is critical to guarantee the LOSA program continues to witness normal behavior. It is essential (particularly in the implementation phase of a LOSA program) that the project management and observation team have the respect of their peers and act in an appropriate manner to safeguard the reputation of the program. Programs with a poor reputation have difficulty gaining acceptance among operators and management, thereby making it harder to initiate change. Observers should be selected from a variety of stations and ranks to ensure a broad cross-section of data is collected from a variety of perspectives and to reduce the chance of normalization in the data.

(5) Managing Change Process

It is imperative that LOSA data are used appropriately to initiate safety change within the organization following a round of assessment. It is recommended that a LOSA Program:

1. Obtains a baseline measurement,
2. Provides detailed analysis and risk assessment of identified findings,
3. Identifies and assesses potential changes to mitigate identified risks,
4. Ensures appropriate actions are documented and implemented,
5. Allows appropriate time for actions to have an effect, and
6. Measures effectiveness of implemented actions.

VII. Next Steps

This guideline should be used to lead any future implementation of an M-LOSA or R-LOSA. A few complete cycles of implementation processes will also help assess the contents, structure, and language of this guideline.

Future implementation should focus on evaluating the implementation outcomes, for instance,

- identifying commonalities and trends,
- assessing risks to prioritize corporate safety resources and effort,
- tracking corrective actions, and
- monitoring repetitive findings to assess the effectiveness of prescribed corrective actions.

Outcome assessment of a LOSA implementation will help generate more buy-in of the program, and guide identification of leading indicators of potential (operational) safety issues, service issues, and personnel injuries (occupational safety issues).

The M-LOSA or R-LOSA program is expected to positively leverage peer pressure to encourage behavioral change. The periodic assessments can help evaluate whether identified problems have been resolved, as well as the effectiveness of safety recommendations. A key factor for the implementation team is to set the frequency and scale of LOSA observations.

As more organizations implement LOSA programs, an industry-wide LOSA information sharing meeting may be held biannually to exchange best practices and lessons learned, in addition to zooming in on fleet-wide problems. It is a priority to involve more airlines in the M-LOSA and/or R-LOSA initiative, as well as participants from the regional airlines and Maintenance Repair & Overhaul (MROs) communities.

Appendix A. Organizational Change Management – Stakeholder Strategy

STAKEHOLDER PROFILE NAME	
Profile Description Defining characteristics of this group	**Significant Changes This Group Will Experience**
▪	▪
▪	▪
▪	▪
▪	▪
▪	▪
OVERALL CHANGE ASSESSMENT: □ HIGH □ MEDIUM □ LOW	

Involvement Needs	**Communication Needs**	**Training/Education Needs**
1. A.		I.
2. B.		II.
3. C.		III.
4. D.		IV.
5. E.		V.
6. F.		VI.

Key Activities with Timeline for Involvement, Communication, Training/Education Strategies																	
Months	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Involvement																		
Communication																		
Training																		

Source: *Workshop on Project Management for Supply Chain Managers.* Center for Supply Chain Management Studies. Saint Louis University. August 5 & 12, 2011.

Appendix B. Resource Requirements – Responsible/Accountable/Consultted/Informed Chart

R- Responsible (for doing work)
A- Accountable (approving authority)
C- Consulted
I- Informed

Person or Functional Role

Deliverable						

Analyzing RACI Chart

Horizontal Analysis

If You Find:	Then Ask
No R's	Is job getting done? Some roles may be waiting to approve, be consulted, or informed. No one sees their role to take the initiative.
Too many R's	Is this a sign of "over the wall" activities? "Just get it of my desk ASAP!"
No A's	Why not? There must be an "A." Accountability should be pushed down to the most appropriate level.
Too many A's	Is there confusion? "I thought you had it!" It also creates confusion because every person with an "A" has a different view of how it is or should be done.

Vertical Analysis

If You Find:	Then Ask
Lots of R's	Can or need the individual(s) stay on top of so much? Can the decision/activity be broken into smaller, more manageable functions?
No empty spaces	Does the individual(s) need to be involved in so many activities? Are they a "gatekeeper" or could management by exception principles be used? Can C's be reduced I's, or left to the individual's discretion when something needs particular attention?
No R's or A's	Should this functional role be eliminated? Have processes changed to a point where resources should be re-utilized?
Too many A's	Does a proper "segregation of duties" exist? Should other groups be accountable for some of these activities to ensure checks and balances and accurate decision making throughout the process? Is this a "bottleneck" in the process – is everyone waiting for decisions or direction?
Qualifications	Does the type or degree of participation fit the qualifications of this role?

Source: *Workshop on Project Management for Supply Chain Managers.* Center for Supply Chain Management Studies. Saint Louis University. August 5 & 12, 2011.

Appendix C. Written Protocols for LOSA Observers

This section includes some written protocols you can use when you deem them necessary.

1. Introduce yourself

A: Hey, man, how is it going? I am Bob Jones from Hangar 8. My role today here is a LOSA observer. Have you heard of LOSA before? ---------- [pause for response]

[If "Yes"]

That's great, man. As you probably recall from the LOSA awareness training you attended and all the nice looking posters we have around our facility, LOSA is a peer-to-peer observation of normal operations. As the observer, my goal is to be a "fly-on-the-wall" and step back to allow you do your job as you do every day. Please try to forget I am even here. Here are some observation forms that I will use as a checklist in case I forget something. I may take notes from time to time. But let me assure you there is no place to record any identifiable personal information in this form, and I was trained to not write down any identifiable information. Once I complete the observation, I may ask you a couple of questions regarding some demographics or things to help clarify questions I may have during the observations. You are welcome to ask me any questions too. The completed observation form will be turned into the LOSA program manager's office, where they will be entered into a secured database and further analyzed. We can expect to see a briefing report on this round of LOSA in a month. The report does not contain any identifiable information. In fact, it does not say anything about any individual observation, and instead it is a summary of findings aggregating all observations.

Do you have any questions about what I just said? Are you willing to take part in LOSA? ---------- [pause for response]

[If "No"]

Let me give you some background information about the LOSA program, which stands for Line Operations Safety Assessment. LOSA adopts truly proactive and predictive strategy to address aviation safety. As a voluntary safety program, LOSA collects safety data during normal airline operations and was originally designed for flight deck operations. The hazards that threaten the safety of flight deck operations are not unique to that environment. Similar problems are present during maintenance and ramp operations.

As you probably recall from the LOSA awareness training you attended and all the nice looking posters we have around our facility, LOSA is a peer-to-peer observation of normal operations. As the observer, my goal is to be a "fly-on-the-wall" and step back to allow you do your job as you every day. Please try to forget I am even here. Here are some observation forms that I will use as a checklist in case I forget something. I may take notes from time to time. But let me ensure you there is no place to record any identifiable personal information in this form, and I was trained to not write down any identifiable information. Once I complete the observation, I may ask you a couple of questions regarding some demographics or things to help clarify questions I may have during the observations. You are welcome to ask me any questions too. The completed observation form will be turned into the LOSA program manager's office, where they will be entered into a secured database and further analyzed. We can expect to see a briefing report on this round of LOSA in a month. The report does not contain any identifiable information, in fact, it does not say anything about any individual observation, and instead it is a summary of findings aggregating all observations.

Do you have any questions about what I just said? Are you willing to take part in LOSA? ---------- [pause for response]

2. Answer some common expected questions about LOSA program and observations

2.a Will you report me if I do something wrong? Will I get into trouble?

A: No, I will not report you and you will not get into trouble, let me assure you of that. The purpose of the LOSA observations is to get a reading of our normal operations. All observations are of a non-jeopardy nature, and that all data will be kept strictly confidential. Here is a letter signed by the highest level of management within maintenance or ground operations to guarantee that. It is also endorsed by our employee groups' representatives.

2.b What is in it for me?

A: A LOSA program offers many benefits, for example, identifying strengths and weaknesses of normal operations, reducing undesirable events and consequently operating costs, and improving efficiency. A LOSA program is very relevant to the frontline employees like you, here are some reasons why:

- *Assess the Degree of Transfer of Training*. A LOSA provides a consistent measure of the adequacy and focus of training programs that allow an operator to manage those programs effectively.

- *Check the Quality and Usability of Procedures.* A LOSA provides insights about potential problems with procedures. A LOSA will locate problematic procedures and policies via poor adherence rates. A LOSA can also identify the extent of procedural deviations across tasks or fleets.
- *Identify Design Problems in the Human/Machine Interface*. A LOSA captures aircraft design, tooling design, and ground service equipment design issues for which technicians and ground servicing personnel have developed "work arounds." Some of these interface issues may be able to be fixed so that no work arounds are required.
- *Understand Frontline Employees' Shortcuts and Workarounds*. With experience comes expertise; frontline employees learn ways to save time and be more efficient. These techniques are rarely seen in a traditional audit, when performance is usually done "by the book." A LOSA provides an opportunity for the organization to capture collective expertise from within the frontline employee group, and then share that information with all its employees through formal organization communication channels. Using LOSA, false expertise — the adoption of a shortcut or work around that is flawed in its safety assumptions — can also be identified and remedied.
- *Provide a Rationale for Allocation of Resources*. Because LOSA results highlight both the strengths and weaknesses in an organization, the results provide a data-driven rationale for prioritizing and allocating scarce organizational resources toward continuous improvement.

2.c What are you going to do with the data?

I will submit the observational data I gather to the LOSA program manager. A safety analyst will enter the data into a designated database. Please note that the LOSA observational data housed in the database do not contain any identifying information such as employee name or employee number. LOSA data can be used to

- Identify threats in the operating environment.
- Identify threats from within the maintenance or ramp operations.
- Assess the degree of transference of training.
- Check the quality and usability of procedures.
- Identify design problems in the human/machine interface.
- Understand frontline employees' shortcuts and workarounds.
- Assess safety margins.
- Provide a baseline for organizational change.
- Provide a rationale for allocation of resources.

2.d Don't you have a job to do somewhere?

A: LOSA is a volunteer based program. I volunteered to assist our organization in reducing threats and errors in a non-punitive manner. You can be a volunteer LOSA observer too. This is a benefit to us and our fellow employees. LOSA relies upon trust and open communication on the peer-to-peer level. My training and observations are scheduled during my normal work shift.

3. Excuse yourself from casual conversation with the technicians being observed

A: I would love to chat more about that game. However, right now I can't. I am sorry. I need to be a "fly-on-the-wall." To allow LOSA capture a snapshot of true normal operations, please ignore my presence. Let us catch up later.

4. Respond to technical requests for help from the technicians being observed

A: I would love to discuss those with you. However, right now I can't. I am sorry. I need to be a "fly-on-the-wall." To allow LOSA capture a snapshot of true normal operations, please ignore my presence. I will make sure that I answer your questions right after I complete my observation here.

5. Respond to inquiries from management, supervisor, or lead who may be walking by

A: Hello, I am Bob Jones from Hanger 8. I am a LOSA observer conducting observations here today. I checked in with the management/supervisor/lead this morning. Here is a copy of letter from the VP of operations about this round of LOSA observations.

6. Intervene immediately in what the technicians are doing if it may impact the individual's safety, aircraft airworthiness or potential damage to equipment

A: Sorry I in terrupted your w ork ju st now b ecause I saw an i mminent d anger to yo u, (o r/and the air craft, the equipment), or the aircraft was going to be left in a non-airworthy condition.

Sorry I interrupted your work just now because I noticed you were unaware of this error. I did not wait for you to finish a task and then have you backtrack for 30 minutes on the task to get to the error.

7. Conclude the observation and if needed, conduct a brief discussion with the technicians being observed

A: Thank you so much for allowing me to observe you today. I want to assure you that your identity will remain anonymous. We, LOSA observers were trained to not record your name or employee number on the LOSA observation forms.

May I ask you a couple of questions? You don't need to answer any of them if you don't want to or don't feel comfortable about sharing the information.

Thank you for clarifying those. Do you have any questions for me? Here is my (or/and the LOSA program manager's) contact information, in case you think of any questions and you need to get hold of us.

Appendix D. Frequently Asked Questions About M-LOSA and R-LOSA Programs

General Background

1. What is LOSA?

A: A Line Operations Safety Assessment (LOSA) is an observational program for collecting safety-related data during normal operations. It is a means for a company to self-assess their safety margins. Monitoring routine operations, the cornerstone of the LOSA process, identifies at-risk behaviors so that they can be proactively managed. The process also reinforces positive behaviors. LOSA, a voluntary, non-threatening, non-punitive, peer-to-peer observational process, has been implemented in airline flight operations since the late 1990s. Due to the success of flight LOSA, the process has been expanded to other areas of the aviation operations, such as air traffic control, dispatch, cabin operations, maintenance, customer service, and ramp operations. On the flight side, LOSA stands for "Line Operations Safety Audit." To better promote voluntary participation and a proactive safety culture, several organizations (e.g., International Aviation Transport Association) now use LOSA as an acronym for "Line Operations Safety Assessment."

2. Is LOSA just another audit program? We already have similar audit programs running!

A: LOSA is different from audit programs conducted by QA Departments, Safety Departments, or external agencies. One essential characteristic of LOSA is "peer-to-peer observations" of normal operations. Maintenance LOSA and Ramp LOSA observations are not carried out by auditors — they are carried out by peers. There are two advantages of having peers conduct the observations. First, it is less intrusive. Let's face it — it is natural for people to "work to the rules" when being watched by an auditor. These altered behaviors do not provide an accurate reading of how work is accomplished during normal operations. On the other hand, frontline employees, while they may alter their behaviors at the start of a LOSA program, soon ease back into their normal behavior when peers conduct the observation. Second, as subject matter experts, who are familiar with local operations and environment, peer observers may be particularly insightful regarding where, when, and what to look for during an observation. LOSA complements other safety programs (e.g., Aviation Safety Action Program, Event Reporting) in a Safety Management System as a predictive hazard identification process.

3. What are threats? What are errors?

A: Threat and Error Management (TEM) provides an underlying framework for LOSA data collection, recognizing that threats and errors are likely to occur in normal operations.

A *threat* is any condition that increases complexity of the operations and if not managed properly can decrease the safety margin. An *error* is a mistake that is made when threats are mismanaged. Errors increase the probability of adverse operational events during maintenance or during ground operations. Errors normally occur when threats are mismanaged. However, the threat-error linkage is not necessarily straightforward, and it may not always be possible to observe the threats that lead to an error. Error outcomes can be of three types: inconsequential (i.e., no effect on safety), an undesired operational state (a risky or unsafe condition for the aircraft, equipment, and/or personnel), or additional error(s) linked together across time. Managing an undesired operational state can be considered the last opportunity to avoid an unsafe outcome.

4. My company has many safety programs. Why do we want LOSA?

A: Managing risks associated with hazards has become increasingly important in modern organizations, especially as the aviation industry is moving toward implementation of a Safety Management System. Three methods can be used to find hazards that can be assessed for risk:

1) *Reactive* hazard identification processes are investigations of accidents and incidents to determine the underlying factors (hazards) that lead to the accident/incident.
2) *Proactive* hazard identification processes look for at-risk behaviors (hazards) before they lead to accidents/incidents, such as QA audits and Hazard Reporting Systems.
3) *Predictive* hazard identification processes also look for at-risk behaviors (hazards) before they lead to accidents/incidents, but these processes involve much more data collection than proactive processes. This allows the prediction of accidents/incidents. LOSA is a primary process for predictive hazard identification.

During a LOSA observation, observers record and code identifiable threats and errors and how those threats and errors are managed. The data from LOSA observations provide indicators of organizational strengths and weaknesses, which facilitate the development of countermeasures to operational threats and errors.

Frontline Employees

5. My station's safety performance is great. If it ain't broken, don't fix it. I don't think we need LOSA.

A: Current great safety performance does not mean there are no safety risks or hazards lurking about. Maybe you have just been lucky. The Federal Aviation Administration (FAA) will soon require through regulation that 121 operators implement a Safety Management System (SMS). The SMS will require that you have reactive, proactive, and predictive hazard identification processes in place. LOSA will meet the predictive hazard identification process requirement.

6. What is in it for me?

A: A LOSA program offers many benefits, for example, identifying strengths and weaknesses of normal operations, reducing undesirable events and consequently operating costs, and improving efficiency. A LOSA program is very relevant to the frontline employees like you, and here are some reasons why:

- *Assess the Degree of Transfer of Training*. A LOSA provides a consistent measure of the adequacy and focus of training programs that allow an operator to manage those programs effectively.
- *Check the Quality and Usability of Procedures*. A LOSA provides insights about potential problems with procedures. A LOSA will locate problematic procedures and policies via poor adherence rates. A LOSA can also identify the extent of procedural deviations across tasks or fleets.
- *Identify Design Problems in the Human/Machine Interface*. A LOSA captures aircraft design, tooling design, and ground service equipment design issues for which technicians and ground servicing personnel have developed "work arounds." Some of these interface issues may be fixable so that no work arounds are required.
- *Understand Frontline Employees' Shortcuts and Workarounds*. With experience comes expertise; frontline employees learn ways to save time and be more efficient. These techniques are rarely seen in a traditional audit, when performance is usually done "by the book." A LOSA provides an opportunity for the organization to capture collective expertise from within the frontline employee group, and then share that information with all its employees through formal organization communication channels. Using LOSA, false expertise — the adoption of a shortcut or work around that is flawed in its safety assumptions — can also be identified and remedied.
- *Provide a Rationale for Allocation of Resources*. Because LOSA results highlight both the strengths and weaknesses in an organization, the results provide a data-driven rationale for prioritizing and allocating scarce organizational resources toward continuous improvement.

7. Do I have to take off work to be a LOSA observer?

A: No. Your training and observations will be scheduled during your normal work shift.

8. Will LOSA observers report me to the company if I do something wrong?

A: No. LOSA is a non-punitive safety program, and your identity will remain anonymous. LOSA observers do not record your name or employee number on the LOSA observation forms. It is not a part of an observer's task to report your work performance. However, a LOSA observer is trained to intervene and fix a problem if they see that a personal injury, equipment damage, or aircraft damage is about to occur. In addition, during a Maintenance LOSA observation, the observer may see that a task has been done incorrectly, leading to an airworthiness issue. In this situation, the observer needs to intervene at some point in the task and get the technician(s) to fix the problem, so that the aircraft is airworthy after task completion. Even in these situations, employee names are not connected to the observation. Nobody's name is ever reported to management.

9. Do I have to participate in LOSA program as an observer?

A: No. LOSA is a volunteer based program. Volunteering to assist your organization in reducing threats and errors in a non-punitive manner is a benefit to you and your fellow employees. LOSA relies upon trust and open communication on the peer-to-peer level. A volunteer has the personal drive and motivation toward the success of the program versus someone who is told they must engage.

10. Do I have to participate in LOSA program as an observed worker?

A: LOSA is a voluntary program in which people agree to participate. If a LOSA observer is going to watch you carrying out a turn on the ramp or observe you carrying out a maintenance task, you have a right to refuse to be observed. However, after having the program purpose and methodology explained to you, the hope is that you will be happy to be observed. Each individual carrier or ground operator is fully responsible for interpreting and defining voluntary participation to its frontline employees to reach a mutual understanding.

Manager/Lead/Supervisor

11. As a manager/lead/supervisor, do I let my people skip work to conduct LOSA observations?

A: Staff do not "skip work" when they carry out a LOSA observation. Management supports the program, and the staff volunteer to be LOSA observers as part of their job. The real issue is how many observations can be carried out and still make sure all of the work of the organization gets done. Ideally, with senior management's support, there will be enough man power to allow LOSA observations to be conducted. The number of LOSA observations that can be carried out during a given time period will be dependent on workload and staffing. The frequency can be one observation per shift, one observation per day, or two to three observations each week — whatever can be accommodated. Based on previous successes, LOSA can be used for even small operations where the trained observers are part of the working crew.

12. Does LOSA ask my employees to report on each other?

A: No. Employee names are NEVER recorded on the LOSA observation forms. LOSA observers report on the behaviors of employees and their systemic processes, not the employees themselves. The program collects data and trends of these behaviors and processes without punitive consequences. The foundation of LOSA is that it is peer-to-peer and non-punitive. Since peers are observing peers, with a non-punitive understanding, your employees will have a more conducive environment for an observation of realistic behavior and processes. This increases the opportunity for the observer to observe the associated risks.

13. Will LOSA remove all threats?

A: No. LOSA is not a "Silver Bullet," but it does provide your organization the benefit of data collection and trending. This data will help identify the tacit and unknown threats to your system and processes. LOSA should not be viewed as a standalone process but a complement to other Safety Management System processes already in place.

Appendix E. A List of Acronyms

A4A – Airlines for America (formerly known as Air Transport Association of America)

AC – Advisory Circular

AMM – Aircraft Maintenance Manual

ASAP – Aviation Safety Action Program

ASRS – Aviation Safety Reporting System

ATC – Ai Traffic Control

CASS – Continuing Analysis and Surveillance System

CBT – Computer-based Training

FAA – Federal Aviation Administration

FOD – Foreign Object Damage

FOQA – Flight Operations Quality Assurance

GSE – Ground Support Equipment

ICAO – International Civil Aviation Organization

LOTO – Lock-Out and Tag-Out

LOSA – Line Operations Safety Assessment

MCDBA – Microsoft Certified Database Administrator

MCSE – Microsoft Certified Systems Engineer

MCTS – Microsoft Certified Technology Specialist

MEDA – Maintenance Error Decision Aid

MEL – Minimum Equipment List

M-LOSA – Maintenance Line Operations Safety Audit

MRO – Maintenance, Repair & Overhaul

NOSS – Normal Operations Safety Survey

QA – Quality Assurance

RACI – Responsible/Accountable/Consulted/Informed

REDA – Ramp Error Decision Aid

R-LOSA – Ramp Line Operations Safety Audit

ROI – Return on Investment

SA – Safety Assurance

SMS – Safety Management System

SOP – Standard Operating Procedure

SQL – Structured Query Language

SRM – Safety Risk Management

TEM – Threat and Error Management